Solid Waste Management (SWM) at a University Campus (Part 2/10): Review on Legal Framework and Background to SWM, in Kenya

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Abstract. This review is a second-piece, in a series of 10. It is focused on SWM, at a Kenyan context, and it is the most comprehensive and up-to-date coverage (currently available) on Legal-Foundation/framework, to SWM, in Kenya (proving chronological-account for the last 70 years), and including: Codes, Acts, Regulations, Rules, Policies, Bills, Action-Plans, the Constitution, Flagship-projects, and a Product-Ban. This review have justified, that Kenya, indeed, has made substantial-efforts, at the policy-arena, to oversee, regulate, and promote good practices, in SWM. The relevant efforts, manifested by Kenya, as: (1) being a signatory, or a party-to, the main International-Conventions and Treaties; (2) enacting numerous laws and by-laws; and (3) creating institutions and systems, at different-levels of governance. The problem, however, is in the proper implementation/enforcement of the laws. Logically, even most progressive laws, are worth absolutely nothing, and remained good, only on-paper, if not implemented. The task, therefore, remains, for the national and local governments, as well as other SWM stakeholders, to make every possible effort strictly implementing the existing laws and regulations. To achieve this task the capacity development in, and financial-sustainability of, MSWM, is necessary. This study have also exposed multi-dimensional and complex nature of the existent challenge of MSWM, in the country. To achieve the SDGs and the Kenya Vision-2030, Kenya should focus (as a long-time objective) on a complete transformation, of the current unsatisfactory MWM-system, to sustainable waste and resource management. Ambitious target of 100% waste-collection, to all urban citizens (regardless of income-level, and including: informal-settlements, slums, and peri-urban areas), should be focused-on. An innovative Results-Based Financing model, of SWM; Upgrading of the current waste-dumping sites to designed sanitary-landfills; and Change of habits, and cultural-perceptions, towards waste, was also proposed.

Keywords: Environmental law, local government, good governance, Waste hierarchy, ISWM, capacity development.

1. Introduction.
The previous paper (#1), of this series, has covered International Protocols, Conventions, Agreements, and commitments to Environmentally-sound management of wastes, at a global context. All types of solid-wastes were also examined, including radioactive, hazardous/toxic, plastic, oil-waste/spills, e-waste, POPs, as well as Municipal Solid Waste-Management, although to a limited extend. This paper, on the other hand, will be focused on the Kenyan-SWM-laws, by-laws, strategies, etc. Also it will be limited to only Municipal Solid-Waste-Management practices, challenges, and opportunities.

2. Subject-matter in a Kenyan context.
2.1.1. Geography.
According to CIA (2012), the Republic of Kenya is the world’s 47th largest country (after Madagascar). It spans a territorial-area of 582,646 km², consisting of 571,416 km² land-area and 11,230 km² of water-surface (KNBS, 2016). Of the total land-area, approximately 490,000 km² (85%) are classified as arid and semi-arid-land (ASALs) (UNDP in Kenya, 2016). BBC: Country Profile (2017) reported that Kenya is situated on the equator, on Africa’s East-coast; it lies between latitudes 5°N and 5°S, and longitudes 34° and 42°E. It is bordered by Somalia, to the East; Ethiopia, to the North; Sudan, to the North-West; Uganda, to the West; and Tanzania, to the South. Two major water-bodies: the Indian Ocean, to the East; and Lake Victoria, to the West, also help define Kenya’s borders. With only 647 cubic-meters of water, per capita, per-year, Kenya is classified as a ‘water-scarce’ country, with the Falkenmark-index of 4, for water-availability (see Falkenmark & Widstrand, 1989).
2.1.2. Climate
Due to its large territory and geography, Kenya’s climate varies considerably; and it is classified into 8 sub-types (see Figure 1).
According to Starovoytova & Namango (2016); and Starovoytova et al. (2016a), Kenya is situated at-the-equator, and is subsequently-influenced by the-Inter-Tropical-Convergence-Zone (ITCZ), as-well-as the-El-Nino-Southern-Oscillation (ENSO)-phenomenon. The-ITCZ is a-fluctuating low-pressure-zone, characterized by thunderstorms and heavy-rainfall. ENSO refers to an-unusual-warming (El-Nino) and cooling (La-Nina) of the-waters, of the-Pacific-Ocean, which occurs in-association-with changes in-atmospheric-pressure, known-as the-Southern-Oscillation. ENSO occurs with a-periodicity of approximately 5 years, and is associated-with seasonal-rainfall-anomalies, in-the-tropics, in-the-form of droughts, in-some-regions, and floods, in-other-regions. ITCZ and ENSO affect precipitation, in-a-wide-belt, in-the-tropics. The-passage of the-ITCZ, results, for Kenya, in two-annual-rain-periods; one-short, in-October-December, and a-longer-one, in-the-period of March-June. According to Malesu et al. (2007), an-average-annual-rainfall is relatively-high, but rains are poorly-distributed, both; spatially, and temporally, leaving some-areas, of the-country, experiencing dry-spells, while other-areas have occurrences of floods, during the-same-season. For-example, according to Starovoytova (2012), in-the-North-East, rainfall can-average only 30 cm/year, yet in the-Lake-Victoria-basin, rainfall is as-high-as 175-200 cm/year.

2.1.4. Economy

Kenya had an-estimated national-GDP of USD 60.9 billion, in-2014, and Kenya’s Gross- Domestic-Product (GDP), at purchasing-power-parity, is growing, steadily, from USD 136.4 billion (2014 est.) to USD 144.1 billion (2015 est.); and to USD 152.7 billion (2016 est.). The-GDP, per-capita, in-Kenya, was last-recorded at USD 1143.10, in-2016 (equivalent to 9 % of the world’s-average) (Trading Economics). Approximately 42% of Kenya’s national-GDP is derived from its-natural-resource-sectors (i.e. agriculture, forestry, fishing, water-supply, and energy). The-services-sector (which includes transport and communications, wholesale and retail-trade, and financial and other-services) accounts for about half of GDP. The-industry-sector
(manufacturing, construction, mining, and quarrying) contributes the-remaining 10%. At a-regional-level, a free-trade-area was launched by the East-African-Community (EAC), in-2005, and a-Common-Market, in-July 2010 (World-Bank, 2014).

2.1.5. Political-structure
Kenya is a-unitary-state, with a-multiparty-political-system. In-2013, Kenya introduced a-devolved two-tier governmental-system, consisting of a-national-government and 47 semi-autonomous-county-governments (each headed by a-Governor). Under the-system of devolution, county-governments play a-major-role, in-service-delivery, including responsibility for waste-management (Kenya Law-Reports, 2010).

2.2. Kenya: Legal-Foundation to SWM.
According to UARK (2016), Kenya has about 77 statutes, which relate to-environmental-concerns. The-following-account, however, reflects statutes, pertinent to-solid-waste and its-management. SWM policy-architecture, in-Kenya (including Codes, Acts, Regulations, Rules, Policies, Bills, Action-Plans, the-Constitution, Flagship-projects, and a-Product-Ban) is summarized, in-the-chronological-order, of main-policy-documents. The-timeframe, considered here is from the-very-inception of SWM-policy frameworks, in-Kenya (starting from the-oldest SWM-policy-document, of 1948, to July, 2017). This-coverage makes the-study the-most-up-to-date and comprehensive (in-both; time-scale and details), as compared to-previous-reviews of SWM-policies, in-Kenya (see Haregu et al., 2017; UARK, 2016; and Njoroge et al., 2014; among-others). The-timeframe is as follows:

(1) 1948 The-Penal-Code, Chapter 63, which-made-it an-offence, for anyone, to-voluntarily ‘vitiate the atmosphere’, in-any-place, to-harm the-health of persons-dwelling, or携带-on-business, in-the-neighborhood, or passing along a-public-way (Section 192); and to ‘corrupt or foul the water’ of any-public-spring or reservoir, to-render it less-fit for-the-purpose, for-which it is ordinarily-used (Section 191) (Republic of Kenya, 1948).

(2) 1963 Local-Government-Act (Cap 265, Laws of Kenya) deals with kinds of refuse and effluent, and where such-service is established, compels its-use, by persons to-whom the-services is available; which vested in-local-authorities (i.e., municipal/town/urban councils) powers, to-establish and maintain, sanitary- services, for-the-removal, and destruction, or management of refuse and effluent (Section 160a) (Republic of Kenya, 1963).

(3) 1977 The-Factories-Act (Cap 514, Laws of Kenya) Section 13, makes it mandatory, for every-factory-owner, to-ensure, that the-factory-environment is kept in a-clean-state, free from effluvia, arising from any-drain, sanitary-convenience, or nuisance. Subsections (a) and (b) require accumulations of dirt and refuse to-be removed, daily (Republic of Kenya, 1977).

(4) 1985 The Radiation-Protection-Act (Cap 243, Laws of Kenya) – Section 16 (2) prohibits manufacturing, possessing, selling, disposing-off, importing, or exporting any-irradiating-device, or radioactive-material, except under and in-accordance-with a-license, issued. Alternative-action will account to an-offence and liable to-imprisonment for not more than two-years (Republic of Kenya, 1985).

(5) 1986 Public-Health-Act (Cap 242, Laws of Kenya) makes provision for securing and maintaining health, including disposing of wastes, appropriately. Section 115, of the-Act, states that no person shall-cause a-nuisance, or cause to-exist, on any-land, or premises, any-condition, liable to-harm or endanger human-health. It defines such-nuisance or conditions, under Section 118, as: waste-pipes, sewers, drains, or refuse-pits, whose-condition, placement, or construction, in-the-opinion of the-medical-officer of health, would damage health. Other-nuisances are any-accumulation of materials, or refuse, that in-the-opinion of the-officer, is likely to-harbor rats or other-vermin (Republic of Kenya, 1986).

(6) 1987 Building-Code (Cap 242, Laws of Kenya), Section 239 (1) dealing with the-depositing of debris on streets, states that any-person who (except with the-prior-consent of the-council) deposit any-building-debris, upon any-street, shall be guilty of an-offence (Republic of Kenya, 1987).

(7) 1992 Food, Drugs and Chemical-Substances-Act (Cap 254, Laws of Kenya), makes it an-offence-to-use, or dispose of any-chemical-substance, in-a-manner, likely to-cause contamination of food, or water, for human-consumption, or in-a-manner, liable to-be-injurious, or dangerous to-health (Republic of Kenya, 1992).

(8) 1995 Building-Code as an enhanced framework and Revised Building Regulation-Draft;


(11) 1999 Environmental Management and Coordination Act (EMCA) (Sessional-paper No.8 of 1999), providing a structured-approach to environmental-management in-Kenya. In-particular: (i) Part 12 (a) of the-Second-Schedule of the-Act, states that Environmental-Impact-Assessment (EIA) and Environmental-Audits (EA) shall-be-carried-out, for waste-disposal, including site for solid-waste-disposal; (ii) Part II, Section 3(1)
states, that: “every person in Kenya is entitled to a clean and healthy environment and has the duty to safeguard and enhance the environment”; (iii) Part V Section 57, sub-section 1, provides for taxes and fiscal-incentives, disincentives or fees, to-induce or promote the-proper environmental and natural-resources-management, or the-protection or abatement of environmental-degradation; (iv) Part VIII, Section 87 (1), (4) and (v) of the-Act prohibits dangerous-handling and disposal of waste. In-summary, the-waste should-be-transported by licensed-transporter, to licensed-waste-disposal-site/plant, which operated by licensed-personnel. Licenses are renewable, and should-be-valid. The-Act provides that waste- minimization-measures, such-as: treatment, reclamation, and recycling, should-be-employed and that any-person, contravening the-provisions, is liable to-penalties and imprisonment; and (vi) Sections 88 to 93 give guidelines on hazardous-waste, waste-segregation, incineration and recycling of solid-waste, resource recovery, demolition and reconstruction of waste, and treatment and landfills (Republic of Kenya, 1999).

(12) 2003 The-Environmental (Impact Assessment and Audit) Regulations, Legal Notice No 101; Impact assessment establishes rules and procedures, for licensing, conducting, and reporting environmental impact-assessments. This-regulation defines 'waste' as any-matter prescribed to-waste and any-matter whether liquid, solid, gaseous, or radioactive, which is discharged, emitted, or deposited, in the-environment, in such-volume, composition, or manner, likely to-cause an-alteration of the-environment. Part II – The-Project-Report, states, that “A proponent shall prepare a project report stating the-materials to-be-used, products, and by-products, including waste, to-be-generated, by the-project, and the-methods of their-disposal. Part IV - The Environmental Impact Assessment Study Report, states, that a- proponent shall submit to-the-Authority, an-environmental-contents of impact-assessment-study-report, incorporating but not limited-to the-environmental-information on the-products, by-products, and waste generated project. Part V – Environmental-Audit and Monitoring, states that an-environmental-audit-report shall contain an-indication of the-various-materials, including non-manufactured-materials, the-final-products, by-products, and waste-generated (NEMA, 2003).

(13) (a) 2006: The-purpose of the Environmental-Management and Co-ordination (Waste Management) Regulations, Legal Notice No 121 (NEMA, 2006a), is to-provide for guidelines, procedures, and standards for the-environmental-governance, to-ensure compliance. The-regulations also-provide for licensing, monitoring, and enforcement. The-regulations can-be-summarized as-follows: (i) “…The Regulations apply to all categories of waste including solid waste, industrial waste, hazardous, pesticides and toxics, biomedical waste and radioactive substances.”; (ii) “Waste is only disposed at designated waste receptacles” (Section 1, 2 and 3); (iii) “The Waste Management Regulations seek to stop and reverse environmental pollution resulting from solid waste by providing mechanisms for managing solid waste. Such mechanisms include promotion of cleaner production technologies, segregation at sources, recycling and reuse” (Regulation 2; 5; and (iv) “…It is an offence to transport waste without a valid license from NEMA....” (Part 11, Section 10 (1-5), 11, and 12).

(b) 2006 The-Environmental-Management and Co-ordination (Water-Quality) Regulations, Legal-Notice No 120: The-purpose of these-Regulations is to-provide for conservation, management, use and control of water-resources. Part II Section 1-2, of the-Regulations, provides, that persons should-refrain from acts that may, directly or indirectly, cause water-pollution. Hence, no person is allowed to-throw or cause, to-be-thrown any-pollutant, into the-watercourse. Section 6 (a) prohibits the-discharge of any-effluent, from sewage-treatment-works, or industry, among others, into water-sources, without a-valid effluent-discharge-license (NEMA, 2006b).

(14) (a) 2007 Kenya-Vision-2030, is the-long-term development-blueprint, for Kenya, covering the-period 2008-2030, and implemented, through a-series of five-year development-plans. It aims to-transform Kenya into a-newly-industrialized “middle-income country providing a high quality of life to all its citizens by 2030”. Vision 2030 is a-living-document, that was first-published, in-2007, and is updated-periodically, in a-web-hosted-version. It aims, among other-things, to-make Kenya a-nation with a-clean, secure, and sustainable-environment, by 2030. One of the-strategies, identified for realization of the-Vision, is improving waste-management, through design and application, of economic-incentives, and the-commissioning of public-private-partnerships (PPPs), for improved-efficiency in-water and sanitation-delivery. In-Vision 2030, one of the-flagship-projects is the-SWM-initiative, which calls-for relocation of the-Dandora-dumpsite, in Nairobi; and the-development of SWM-systems in five municipalities (Mombasa, Kisumu, Eldoret, Nakuru, and Thika). Although this-Strategy will be piloted, in the-above five-cities and towns, it shall-be-applied countrywide (Republic of Kenya, 2007c).

(b) 2007 The-Environmental-Management and Coordination (Controlled Substances) Regulations, Legal-Notice No 73, describes classification of controlled-substances, and provisions-on licensing, and permit-provision, as-well-as monitoring-provisions for manufacture, packaging, import, and export of controlled-substances (Republic of Kenya, 2007a).

(c) 2007 The-Occupational-Safety and Health-Act deals with chemical-safety, and the-securing of dangerous-parts of machinery. It requires that a-machine (incinerator), whether; fixed or mobile, shall-be-used for work, which they are designed for, and be-operated by a-competent-person. Part IX, Chemical-Safety, Section 83, Subsection IV, states that the-employer shall-develop a-suitable-system for the-safe-collection,
recycling, and disposal (in an environmentally-sound-manner) of chemical-wastes, obsolete-chemicals, and empty-containers of chemicals, to-avoid the-risks to-safety, health of employees, and to-the-environment (Republic of Kenya, 2007d).


(15) 2009 Republic of Kenya, National-Land-Policy (Sessional-Paper No. 3), Section 3.4.3.3: Urban-Environment-Management-Principles, clause 140, stipulates, that: To-address urban-environmental problems the-following-measures shall-be-implemented: (i) Prohibit discharge of untreated-solid and liquid-waste, into rivers, lakes, and the-ocean, by providing appropriate-waste-management-methods; (ii) Encourage and require waste-segregation and labeling, for easier-management; (iii) Regulate all-quarrying and excavation-activities; (iv) Encourage urban-waste re-use and recycling; and (v) Develop a-framework, for rehabilitation of dumping-sites, and land, that has-been-subjected to environmental-degradation (Republic of Kenya, 2009).

(16) 2010 The-Constitution of Kenya – Article 42 of the-Bill of Rights (Chapter 4, of-the-2010-Constitution), states that every-person has-the-right to a-clean and healthy-environment, which includes the-right to-have the-environment protected, for the-benefit of present, and future-generations, through legislative and other-measures. Article 70, guarantees a-clean-environment, as a-claimable-right, by any-citizen, who-feels, that this-right has-been infringed. In-fact, being-alive, which is a-right, protected under the-Constitution, may-frequently depend-on a-person’s-health, and on the-surrounding-environment. Thus, the-mismanagement of the-environment, can-be interpreted as-interference in one’s right-to-life. Besides, Part 2 of the-fourth-Schedule, in the-Constitution, also explicitly provides, that the-County- Governments shall-be responsible for: refuse-removal, refuse-dumps, and solid-waste-disposal (Republic of Kenya, 2010).

(17) 2011 Urban-Areas and Cities-Act, NO. 13; Revised-Edition 2016 [2012], First-Schedule (Section 5): Classification of cities and towns by services, states that a-City – (Population at least 500,000); a-Municipality – (Population at least 250,000); and a-Town – (Population at least 10,000), shall-have the-ability to-provide refuse-collection and MSWM-services (Republic of Kenya, 2011).

(18) (a) 2012 NCCAP: The-National-Climate-Change Action-Plan: Mitigation (2013-2017), is an-extensive 268-page blueprint, addressing Kenya’s priorities and responses to-climate-change-mitigation and adaptation. It states, that although the-share of the-waste-sector, on the country’s total GHG-emissions, is low, GHG-emissions, from the-waste-sector are expected to-increase from 0.8 million tCO2e per-year, in-2010, to 2 million tCO2e, in-2030. Kenya hopes to-reduce GHG-emissions to 15%, below 2010-levels, by the-year 2015, and to 70%, by 2030; a-quite-ambitious-target (GoK_NCCAP, 2013). It-is also-noted, in-the-NCCAP, that methane-capture can-go hand-in-hand with proper-management of solid-waste, thereby improving groundwater-quality, local-air-quality, and safety, as-well-as hygienic-conditions (GoK, KenyaLaw, 2013b). In-Chapter 9 on Waste, holistic, sectoral-analysis aims to-inform the-Kenya Climate-Change Action-Plan and provides the-evidence-base, for prioritizing low-carbon-development- options, and developing-proposals for Nationally-Appropriate-Mitigation-Actions (NAMAs) and REDD+actions. In-addition, it-is also-stated, that: “This is [NCCAP] also subject to international support in the form of finance, investment, technology development and transfer, and capacity-building” (GoK_INDC, 2015).

(b) 2012 The-Public-Health-Act, Section 126, stipulates, that-the-Minister, on the-advice of the-board, may make-rules, and may-confer powers, and impose duties, in-connexion-with the-carrying-out and enforcement, thereof on local-authorities, magistrates, owners, and others, as to: (i) the-drainage of land, streets or premises, the-disposal of offensive-liquids, and the-removal and disposal of rubbish, refuse, manure, and waste-matters. Section 134: Rules for protection of food, pointes-out, that the-Minister, may make-rules regarding all, or any of the-following-matters: the-establishment, locality, supervision, equipment, maintenance, and management of slaughterhouses, and the-disposal of the-waste; Section 118: What constitutes nuisance, Section 1, states, that the-following shall-be-deemed to-be nuisances, liable to-be-dealt-with, in-the-manner, provided. Part (c) reads:” any street, road or any part thereof, any stream, pool, ditch, gutter, watercourse, sink, water-tank, cistern, water-closet, earth-closet, privy, urinal, cesspool, soak-away pit, septic tank, cesspit, soil-pipe, waste-pipe, drain, sewer, garbage receptacle, dust-bin, dung-pit, refuse-pit, slop-tank, ash-pit or manure heap so foul or in such a state or so situated or constructed as in the opinion of the medical officer of health to be offensive or to be injurious or dangerous to health”; and Part (e) states that any-noxious-matter, or waste-water, flowing or discharged, from any-precincts, wherever situated, into any-public-street, or into the-gutter, or side-channel, of any-street, or into- any of watercourse, irrigation-channel, or bed, thereof not approved, for the-reception of such-discharge constitutes to-be a-nuisance (Republic of Kenya, 2012a).

(c) 2012 Country-Government-Act – assigns the-specific-task of implementing nationwide-policies, within their-jurisdiction; in-particular, Section 120: Tariffs and pricing of public-services, Sub-section 3, states that a-tariff-policy, adopted under-subsection (i) shall reflect following guidelines; part (h): promotion of the-economic,
efficient, effective and sustainable-use of resources, the-recycling of waste, and other-appropriate-environmental-objectives (Republic of Kenya, 2012b).


(18) 2013 National-Environment-Policy in-Section 6.3 (Waste-management), states that-the-Government will: (i) Develop an-integrated national-waste-management-strategy; (ii) Promote the-use of economic-incentives, to-manage waste; and (iii) Promote establishment of facilities and incentives for cleaner-production, waste-recovery, recycling, and re-use. Section 6.4 (radiation) indicates, that the-Government will: (i) Maintain an-inventory of sources, types and quantities of radioactive materials, periodically-monitor status and trends and enhance protection-measures; (ii) Strengthen capacities, for handling and management, of radio-active-waste and ionizing-agents; and (iii) Ensure that telecommunication-equipment and structures, conform to the-international-radiation-standards. Besides, Section 6.5 (toxic and hazardous-substances) indicates, that the-Government will: (i) Develop a-national policy on toxic and hazardous-substances; (ii) Establish appropriate-toxic and hazardous-substances disposal-facilities; and (iii) Collaborate with international-community, in-curbing-dumping of obsolete, or banned, toxic and hazardous-substances (NEMA, 2013).

(19) 2015 The-National Solid-Waste-Management-Strategy, by the-National-Environment-Management-Authority (NEMA) is the-most-recent government-action, establishing a-common-platform, for-action, between stakeholders, to-systematically-improve waste-management. It introduces a-new approach, for improved-waste-management, in-Kenya, to-create wealth and employment, and reduce pollution of-the-environment. This-strategy presents 10 minimum-points, for management of-the-existing-waste-management-facilities, so-as to-continuously promote compliance-with the-waste-management-regulations, within the 47 counties. This-strategy is to-be-implemented, through 5 key-objectives, to: (i) formulate policies, legislations, and economic-instruments, to-reduce waste-quantities; (ii) inculcate responsible-public-behavior on waste-management; (iii) promote waste-segregation, at-source; (iv) promote resource-recovery, for materials and energy-generation; and (v) establish environmentally- sound-infrastructure and systems, for waste-management. Successful-implementation of this-strategy requires the-involvement of several-actors: (1) Ministry of Environment, Water and Natural-Resources; (2) NEMA; (3) County-Governments; (4) The-National-Treasury; (5) Civil-Society-Organizations (CSOs) and NGOs; (6) Private-Sector; and (7) the-Citizens/Public. For the-detailed-roles of each of-the-actors see (NEMA, 2015).

(20) (a) 2017 The-National Waste-Management-Bill, for an-Act of Parliament to-establish an-appropriate legal and institutional-framework, for-the-efficient and sustainable-management of waste, in-the-framework of-the-green-economy, the-realization of Kenya-Vision 2030 zero-waste-goal, and the-provision of a-clean and healthy-environment, for all-Kenyans, for connected-purposes. This-Act shall-come into-operation on-such-date, as the-Cabinet-Secretary may, by notice Gazette, appoint. It-consists of 7 parts: Part I -- preliminary; Part II-- policy coordination and oversight of waste management; Part III-- measures and actions; Part IV-- duties relating to waste management; Part V-- public participation and access to information; Part VI--financial provisions; Part VI-- monitoring and compliance; Part VI-- offences and penalties; and Part VII--miscellaneous provisions (Republic of Kenya, 2017).

(b) 2017 Nationally-Appropriate-Mitigation-Actions (NAMAs) are voluntary, non-binding policy-instruments, that provide a-framework for pursuing a-country’s socioeconomic and development-goals, while contributing towards global-greenhouse-gas mitigation-efforts. Though not explicitly-mentioned in the-Paris-Agreement, NAMAs are currently the only “framework for non-market approach to sustainable development” (as noted in the-Paris-Climate-Agreement) and are expected to-play an-important-role, in helping-developing-countries-plan and execute mitigation-actions. Moreover, the-overall-scope of a-NAMA, i.e., mitigation-action combined-with sustainable-development, leading to-sector transformation, makes it an-ideal-framework to-balance national-development-priorities, with global-climate-actions. NAMAs were first-introduced, at the 13th Conference of Parties, to-the-Kyoto Protocol (COP13), in-Bali, in-2007. The-most-relevant-links, between the-NAMA and the-MDGs, are through Goal 1 “Eradicate Extreme Poverty and Hunger” (Targets 1A and 1B), Goal 3 “Promote Gender Equality and Empower Woman” (Target 3.2) and Goal 7 “Ensure environmental sustainability” (Target 7D). SDG-targets and SD-benefits, resulting from the-NAMA, are: SDG Goals/Indicators # 13; 11;12; 3; 4; 9; 17; 8; 16.6; and 17.1. The-NAMA will showcase a-model, for improved-urban-waste-management, in-developing-countries. It will transition Nairobi’s waste-sector from a-disposal-driven-one to-one of recycling and composting. This will-have numerous-benefits, such-as: affordable waste-collection-services to all-income-areas; increase in-the-amount of waste, collected and recycled; improved health, at household-levels; reduction in GHG-emissions; and direct and indirect-job-creation. The two-distinct-objectives, of this-NAMA, are: (i) Establish infrastructure, for recycling and reuse, of waste to-substantially reduce the-amount of disposed-waste; and (ii) Establish a-framework for-the-private-sector to-participate, in-the-recycling and reuse, of waste. In-particular, under-the-NAMA, up-to 600 tons of waste will be-recycled, every-day, (which accounts, for 25% of Nairobi’s total-waste). This-will-save more than 800,000 tons in CO2e emissions (over the-15 years’ lifetime
of the-NAMA) and add 1,600 jobs to the-economy. Waste-collection-services will become affordable, to-more
than-half a-million low-income-residents, because waste-collection-companies will divert, their-waste from
dumpsites, to-recycling-points, thereby reducing their-operating-costs (NAMA, 2016).

And, finally, 2017 (c) most-recent Kenyan-initiative—Ban on plastic-bags, is an-important attempt to
to-reduce SW, in-the-country. Disposal of plastic-bags has been the-biggest-SWM-problem, in-Kenya (see
Starovoytova et al., 2016b). According to UNEP, close to 100 million-plastic-bags, are given-out, every-year, in-
Kenya, by supermarkets; most of which end-up in-garbage-bins, polluting the-environment. The-Government
was attempting twice, before, in-a-decade, to-eliminate what is perceived as the-country’s worst-litter-problem.
Previous-attempts, to-ban plastic-bags were selective, targeting to-regulate light-weight-carrier-bags,
thickness of less-than 30 microns, which made monitoring of compliance near-impossible. The-current-ban (the-
Legal-Notice took-effect on 28th August, 2017), covers all-plastic-carrier-bags (single-use-bags; carrier-bags
with-handles, and flat-bags without-handles), which are used as-secondary-packages. However, materials, used
for industrial-primary packaging, disposal-bags, for handling of biomedical and hazardous-waste, and garbage-
bin-liners, are exempted. Kenya joins more-than 40 other-nations, that have enacted similar-laws, but Kenya’s is
Far-more-stringent, than all of the-others, to-date; offenders face a-jail-term of four-years, or a-fine of KES 4
million (USD $40,000). Kenya hopes the-ban will greatly-reduce plastic-pollution, but this-goal is estimated to
at the-expense of around 60,000 jobs-lost (Policy-Monitor, 2017).

2.3. Background to SWM, in-Kenya.


Environmental-Performance-Ranking (EPI) of Kenya is 130, out of 180 countries (with Environmental- Health
ranked at 42.96, and Ecosystem-Vitality at 50.12); while in-Sub-Saharan-Africa, Kenya is on 14th place (EPR,
2018). In-particular, Environmental-Health-variable includes: Air-Quality, Water & Sanitation, and Heavy-
Metals/Lead-Exposure, while Ecosystem-Vitality considers: Biodiversity & Habitat, Forests/Tree-Cover-Loss,
Fisheries, Climate & Energy, Air-Pollution, Water-Resources, Wastewater- Treatment, and Agriculture/Sustainable-Nitrogen-Management. The-full-results of the-2018 EPI, including country-
and indicator-level-analysis, are available at epi.yale.edu.

In-Kenya, the-number of urban-residents is expected-to-increase (from 2002-2225) by 256% reaching
16,952,000.00, while waste-generation, is expected-to-double, reaching 0.6 kg/capita/day (World-Bank, 2012).
UNIDO (2009) indicated, that ‘there are no national-statistics on waste-generation levels, in-Kenya’. Nevertheless, some-limited-data was traced, by-this-study; for-example: according to NEMA (2012), municipal-
waste-generation, per-capita, in-urban-areas, of Kenya, is estimated to-range, between 0.29 and 0.66 kg/day.
The-figures are compatible with the-overall waste-generation-rate for East-African-Countries urban-centers,
which vary, on-average, between 0.26 (low-income) and 0.78 (high-income) kg/cap/day (Scheinberg, 2011;
Oberlin, 2011; Okot-Okumu & Nyenje, 2011; Rotich et al., 2006; Kaseva & Mbuligwe, 2005; Kibwage, 2002).
Similar-waste-generation-rates have also been reported for developing-countries, of other-regions of the-world
(Vidanaarachchi et al., 2006; Achankeng, 2003; Supriyadi et al., 2000).

Moreover, NEMA (2012) stated, that healthcare-waste, generated, in-Kenya, is approximately 909,182
tons/year, with infections-waste comprising 75%. No national-figures, however, could-be-found for the-others-
categories of waste. For municipal-waste, data for 4-major-towns was-found: Nairobi generates about 2,400 tons
waste/day, while Nakuru, Kisumu, and Mombasa, generate 700 tons, 900 tons and 1,500 tons, respectively.
About 61% of these-municipal-waste is generated from residential-areas, 21% from industrial-activities, while
the-rest comes from hospitals, markets, and other-sources (NEMA, 2012). UNIDO (2009) also-pointed-out, that
‘the complexity of waste generated is increasing due to changing production and consumption patterns, increased
urbanization, industrial and service activities’. The-average, per-capita, waste generation, in-the-main-Kenyan-
municipalities, with SW-disposal sites (SWDSs), is approximately 0.46 kg/day; while the-domestic and
commercial-waste takes 70% of the-total-waste, generated, while industrial-waste takes the-remaining-
percentage (NAMA, 2016).

2.3.2. Practices and challenges.

2.3.2.1. Practices Overview.

Gakungu et al. (2011), stated, that the-current WM-situation, in-Kenya, is characterized by the-inability of local-
authorities to-collect all the-waste-generated. Nationally, it-is estimated, that only 40% of the-generated-waste is
collected, for disposal, at designated-disposal-sites (NEMA, 2012). This-figure is comparable to other-urban-
areas, in-developing-countries (Scheinberg, 2011; Vidanaarachchi et al., 2006; Palczenk, 2002; Supriyadi et al.,
2000). Besides, in-some-cities/towns, the-collection-rate is lower than the-national-average; for-example,
according to Munala (2011) and UN-Habitat (2007), about 500 tons of waste, is generated, per-day, in-Kisumu-
city, out of which, only 20% is delivered to-dumpsites. Waste-collection and transportation is limited-by:
inadequate-equipment, personnel, and financial-resources, facing all-local-authorities (NEMA, 2015). For-
instance, Otieno (2010), states that up-to 80% of waste collection-transport is out of service, or in-need of repair.
Uncollected-waste is either; burned in-open-air, or buried in the-backyards, or indiscriminately dumped, (Oberlin, 2011; Liyala 2011; Okot-Omkumu & Nyenje 2011; Simon, 2007) and left to rot, under hot and moist subtropical/tropical climate.

On-the-other-hand, according CSIR (2011), it-is-considered a-best-practice to-reduce the-generation of waste, at-the-source, then recycle and compost (what cannot be reduced), and finally incinerate, or landfill, the-remainder.

UNIDO (2009), identified, that recycling and composting-technologies, in-Kenya, are very-informal and basic, and account for a-merely 8%. For-example, only 21 % of the-technical-institutions, in-Kenya, recycle some of the-wastes while 79 % do not recycle (Gakunju et al., 2011). Schultz et al. (1995) defines recycling as “the process through which materials previously used are collected, processed, remanufactured, and reused”. Recycling, in-Kenya, is practiced informally and selectively; only high-value recyclables (such-as: scrap-metal, glass, paper and cardboards), find their-way-to-recycling firms (Karanja, 2005). Besides, rubber, sludge/used-oil, plastics, etc., are also-recycled, at a-limited-expend, however, most-recycling-technologies are very-informal and rudimentary (NEMA, 2006). In-low-income areas, recyclable-materials are used and reused, for domestic-purposes, and only thrown-away, when they are no longer of any-use to the-owners. In-high-income-areas, domestic-servants will sell these-materials, to-middlemen, to-supplement income, instead of disposing them along-with-the-other-refuse. There are a-few-recycling-plants, in-operation in-Kenya. Although much-more-waste is generated, than can-be-collected, the-recycling-plants have been-operating under their-full-capacity, for years, because most of the-waste-materials are not separated, at the-source (Karanja, 2005), among other-reasons.

Big-companies such-as: Homegrown and Sian, in the-horticultural-industry, undertake their-own vermin-composting-programs. Several other-NGOs and CBOs, are also-using-the-same-technology. Except for manure, that finds ready-market in-agriculture, the-greatest-challenges, facing recycling-activities are: (i) accessing appropriate-technologies; (ii) ensuring-quality; and (iii) finding markets for recycled-products (UNIDO, 2009).

On-the-other-hand, incineration is-a-method of burning waste, which is combustible, at-high-temperatures, in-the-range of 1000°C, to-reduce the-waste to-ashe. Hazardous-waste and healthcare/ medical-waste is mostly-incinerated, however, some of them find their-way into-dumpsites, where they get-mixed with municipal-waste. Therefore, a-lot of non bio-medical-mixed-waste is burnt, openly, in-Kenya. Policies, governing the-appropriate-use of incineration, exist, in-Kenya, but incinerators mostly consist of ovens, or open-pits, used to-burn bandages and blood-products (Karanja, 2005).

None of the-urban-centers, in-Kenya, operate a-sanitary-landfill. Most of the-generated-waste ends-up in-dumpsites, where no waste-compaction and capping (covering waste with soil at the-end of each-day) take-place. It-is estimated, that the-dumpsites, in-Nairobi, handle about 803,000 tons waste/year. Other-major-cities and towns, such-as: Mombasa, Kisumu, and Nakuru, dispose of 1,124 million-tons of waste. Combining with other-smaller-towns, it-is estimated, that 5.26 million-tons of waste are disposed-of, through open-burning and methanation (NEMA, 2012). As there is no source-segregation of waste, in-Kenya, most of the-recovery of resources, takes place at these-dumpsites (UNIDO, 2009).

2.3.2.2. Challenges

Sakurai (2000) has identified the-following-categories of problems, common-to WM, in-developing countries, including Kenya, as: (1) External-problems (population-explosion, rapid-urbanization, expansion of squatter-settlements; Socio-economic-crisis; insufficient-public-education and community-participation); (2) Simultaneously external and internal-problems (rapid-increase in the-volume of municipal and industrial-solid-wastes, lack of waste-reduction- efforts; lack of interest in solid-waste-problems, among central and local-government-authorities; immature-system of local autonomy; lack of coordination among sectors, organizations and municipalities; lack of a-clear-policy on waste-pickers; lack of capacity in-public cleansing-departments, inadequate-development programs for human-resources; friction, between management and labor, within public-cleansing departments or services; inadequate-legal-systems, insufficient-law-enforcement; weak-financial-base); and (3) Internal-problems (Lack of organizational capacity in MWM; lack of short-, medium-, or long-term planning; inadequate-operation and maintenance structure for machinery and equipment, low-utilization-rate; use of technology that is technically, economically or socially inadequate).

According to the-Japan-International-Cooperation-Agency, difficulties, in-SWM, experienced, can-be attributed to the-following-aspects: (i) Problem-factors (Population, economic-level, climate, topography, etc.), including: Increases in waste-quantities; Changes in waste-characteristics; Seasonal variations, floods and other-natural-disasters; Underdeveloped-urban-infrastructure; Operational-difficulties; Difficulties in procuring disposal-sites; and Diversification of city-residents; (ii) Social-aspects: Inadequate-understanding of waste-issues; Unwillingness to-cooperate; Gaps between rich and poor; Formation of slum-areas; and Disintegration of traditional communities; (iii) Institutional-aspects: Lack of policy-objectives; Lack of appropriate-laws, standards or guidelines; Inconclusive decentralization or weak power of municipalities; Inadequate systems concerning organizations in charge of SWM; (iv) Organizational-aspects: Opaque-decision-making-process; Lack of a shared-sense of purpose; Frequent personnel-changes; Lack of organizational-management-capacity;
Lack of policymaking capacity; Lack of coordination and partnership with private waste service providers and other organizations; (v) Financial aspects: Underdeveloped tax-collection-system; Low-priority for SWM in budget allocation; Lack of financial-management-capacity; Lack of financial-planning in anticipation of equipment renewal, etc.; Inadequate assessment of cost-recovery-performance; and Inappropriate-allocation of collected-fees for other-purposes, than SWM-service; and (vi) Technical-aspects: Inadequate-skills; Lack of skilled-human resources; Inadequate policies for human-resources-development (HRD); and Inadequate technical information (JICA, 2009).

In-particular, NEMA (2012) identified the-following-challenges in-MSWM, in-Kenya: Legislative-framework (Lack of SWM-policy; Institutional-arrangements; Gaps in-sector-specific regulations; Lack of Capacity; Inadequate-enforcement); Low-public-awareness; Financial-implications; Level of Economy (high vs. low-income-areas); Infrastructure; illegal-structures and informal-settlement; and Planning for collection-centers and disposal/treatment-sites.

In-addition, more-details, on each of the-following-barriers: (i) Regulatory and Policy-Barriers; (ii) Economic/financial-Barriers; (iii) Technical-Barriers; (iv) Awareness; and (v) Training-Barriers; can be accessed via ‘Kenya-national-profile to assess the chemicals management’, by Republic of Kenya (2011).

Besides, according-to the-Pretoria based Basel Convention Regional Centre: (2000-2006), the-rating of WM-capacity, in-Kenya (as at 2001) was ‘below-average’. Table 1 shows more-recent statistics/summary of the-WM-capacity-situation, in-Kenya.

Table 1: Selected-statistical-data, relevant-to SWM, in-Kenya (NEMA, 2012).

<table>
<thead>
<tr>
<th>Region</th>
<th>Waste handling Mode</th>
<th>No. of Licensed Handlers</th>
<th>Type of Waste</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nairobi</td>
<td>Transporters</td>
<td>48</td>
<td>Municipal/Biodegradable, Used battery, Waste Paper, Plastics, used oil, sludge, sewage, Hazardous/biomedical, Chemicals, Scrap metal</td>
</tr>
<tr>
<td></td>
<td>Incinerators</td>
<td>10</td>
<td>Hazardous/biomedical</td>
</tr>
<tr>
<td></td>
<td>Composters</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Recyclers</td>
<td>10</td>
<td>Waste paper, oil, sludge, scrap metal, plastics</td>
</tr>
<tr>
<td></td>
<td>Dumpsite</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td>Coast Region</td>
<td>Transporters</td>
<td>29</td>
<td>Used oil, sludge, municipal/biodegradable,</td>
</tr>
<tr>
<td></td>
<td>Incinerators</td>
<td>2</td>
<td>Hazardous/biomedical</td>
</tr>
<tr>
<td></td>
<td>Composters</td>
<td>0</td>
<td>Oil, sludge</td>
</tr>
<tr>
<td></td>
<td>Recyclers</td>
<td>7</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Dumpsite</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td>Other Regions</td>
<td>Transporters</td>
<td>18</td>
<td>Municipal/ Biodegradable, scrap metal, Hazardous/biomedical, plastics/ polythene, used oil, sludge</td>
</tr>
<tr>
<td></td>
<td>Incinerators</td>
<td>7</td>
<td>Hazardous/biomedical</td>
</tr>
<tr>
<td></td>
<td>Composters</td>
<td>10</td>
<td>Biodegradable, organic, domestic</td>
</tr>
<tr>
<td></td>
<td>Recyclers</td>
<td>9</td>
<td>Plastics, oil, sludge, hazardous</td>
</tr>
<tr>
<td></td>
<td>Dumpsite</td>
<td>2</td>
<td>Non – hazardous</td>
</tr>
</tbody>
</table>

The-provision of SWM-services is, indeed, an-expensive-undertaking and resources are required to: purchase the-appropriate-equipment and infrastructure, fund the-maintenance and daily-operation of vehicles, and equipment, and train or up-skil personnel, among-others. SWM and street-sweeping is also, often, the-city’s single-largest-source of employment (Achankeng, 2003), and hence it contributes to-increase of wage-bill, further straining the-available-finances. In addition-to inadequate-finances (Kain et al., 2016), other-contributing factors, to current-poor-state of WSWM, in-the-country, are: poor-political and institutional-support, low-awareness and poor-community-attitudes, lack of a-systematic-approach to WM, weak-technical capacity, and poor-implementation of waste-policies and bylaws (Gutherlet et al., 2017; Kain et al., 2016).

Specifically, the-scarcity of resources (e.g., financial, technical, and logistical (Liyala, 2011; Kain et al., 2016), is a-major hindrance to-effective-SWM-practices, in-Kisumu-city (Frediani et al., 2013); the-situation is nor better, and even more-complex, in-other-parts of the-country. For-example, Okalebo and colleagues (2014) pointed-out on-several-challenges, in-SWM, in-Eldoret-town (35 km from the-subject university), as-follows: (1) inadequate-coverage; (2) low-pay and poor-morale; (3) insufficient-staff and resources; (4) lack of the-decision-making-authority, experience, and accountability of the-SWM-staff; (5) the-private-sector and community have showed little-interest, in-participating, in-SWM; (6) the-policy and implementation-instruments, available to
Eldoret-Municipal-Council (EMC), are limited towards the-adoption of multilevel-governance; (7) crisis-management has become the-normal-mode of action; (8) the-complex human-population-dynamics, in-Eldoret, characterized by population-explosion has further aggravated the-problems; and (9) despite the-stipulations, in-the-hylaws of EMC, there is a-strong cultural-attitude --‘NIMBY’ ('not in my backyard') towards waste. A-different ‘spin’ to the-NIMBY concept is given by another-new-term LULU (Locally Unacceptable Land Use), which gives much-more legitimacy to-often well-founded local-community-concerns (Fagan et al., 2001). Selected-studies, including: ITDG-EA (2004); Kibwage & Momanyi (2002); Kiplagat (1999); and Syagga, (1993), identified similar-factors, that inhibit local-authorities, like EMC, in-MW-operations, in-Kenya.

2.3.2.3. Nairobi as an-illustrative-example of MSWM, in-the-country. The-problem of WM, in-Nairobi, Kenyan-capital, has reached a-dangerous-level. The-failure of city-authority to-collect and properly-dispose all-the-waste, generated, has led to-indiscriminate-dumping, pathetic-sanitary-conditions, and incidences of environment-related health-problems (Ikiara et al., 2004). Nairobi’s SWM-situation, which could-be-taken to-generally-represent Kenya’s status, is largely characterized by: low-coverage of waste-collection; pollution, from uncontrolled-dumping of waste; inefficient-public-services; unregulated and uncoordinated-private-sector; and lack of key-SWM infrastructure (such-as transfer-facilities, sanitary-waste-disposal-facilities, and systems for waste-separation). In-addition, the-sector lacks policy and a-strong reuse and recovery-industry (UNEP, 2005).

For-example, according-to (Kasozi & von Blottnitz, 2010), solid-waste, generated on-daily-basis, in-Nairobi, is about 4,016 tons. The-collection-rate is as-low-as 33% (JICA, 2010), which leaves about 2,690 tons uncollected. According-to more-recent-documentation by CCN (2014), average-waste collection levels, have increased, in-Nairobi, from 33%, in-2010, to 56%, in-2014 (highest in-the-country). However, such-figures hiding-up the-gap, between the ‘haves’ and ‘have-nots’ (Wilson et al., 2013).

Where available, waste-collection-services are geographically-skewed, with higher and middle-income residential and commercial-areas better-serviced (Kasozi & von Blottnitz, 2010). Low income-neighborhoods, with poor-infrastructure, are largely-neglected, but when they do receive the-service, although at a-very-limited-extend, it-is free of charge.

A-study by JICA (2010), also-estimated that local-authorities of Nairobi, spend 30% of their-budgets, on-WM and cleansing. Of this, 70% goes to-transportation of waste. To-bridge this-gap, private-sector-involvement, in-WM, is growing. According to NEMA (2015), waste, in-the-central-business-districts of Nairobi, is largely-collected by-the-Government, while private-operators dominate collection, in-residential-areas, at a-fee. Waste-collection in low-income and informal-settlements is mainly-done by organized-groups and CBOs. NEMA issues annual-licenses to-waste-transporters, in-accordance-with the-provisions of the-waste-management-regulations of 2006. However, some-waste transportation-vehicles operate illegally, as they do not meet NEMA-requirements.

The-Nairobi-City-Council collects 500 tons/day, 19 private-licensed-companies collect another 500 tons/day, while waste-recyclers and scavengers collect 350 tons of waste, daily (CCN, 2014). There are over 150 private-sector waste-operators, independently involved, in-various-aspects of WM, indicating a-wider-private-sector-involvement in-WM, in-Nairobi. Community-level-initiatives also-play-a-critical role, throughout the-WM-process; they can take the-form of: (i) Non-Governmental Organizations (NGOs); (ii) Community-Based Organizations (CBOs); and (iii) Individual or Household Initiatives (Ferrara et al., 2008). Community-based organizations (CBOs) and Self-help-Groups operate in-high-density residential areas, of the-city, as primary-waste-collectors, where also segregation is done, at-a-extend. In-high-income-areas, of Nairobi, for-example: an-estimated 200 registered-resident associations, are operating, concerned, among others, in-improving city-cleanliness. They contract, organize, and monitor, private-SWM-collection-services (Bahri, 2005; UNEP, 2004).

On-the-other-hand, waste-collection relies on the-management of infrastructure (ensuring that the-streets are paved and accessible, and zoning-laws against squatters, enforced) regardless of public or private servicing. Private-firms will only be-as-good-as the-infrastructure, which supports them. Private-firms have little-incentive (and virtually zero-technical and financial-capacity) to-repair and maintain roads (Thompson, 2010). As a-result, many of Kenya’s initial-experiences with decentralization, of the-waste-collection-market, manifested in-the-neglect of lower-income-regions.

With an-increasingly-growing-population, Nairobi’s annual-waste-production of 3,121 tons is set-to-more-than-double, by 2030, the-year, by which Kenya is supposed to-be a-middle-income-country, consuming-more and, therefore, generating more-waste. As it stands, only about 27% of the-SWM, generated-daily, makes it to the-Dandora-dumpsite. This would-explain the-multiple mini-dumpsites, found along the-city’s roads and in-open-spaces (Kamunya, 2013). UNEP (2007) had classified Dandora-dumpsite as-one of the-worst-humanitarian-crisis, facing-the-Nairobi-city. According-to Grand Health Challenges Blog: Dandora is a health and environmental disaster. At 43 hectares, equivalent to 60 football pitches, it has grown much too vast to be managed and the waste has been contaminating the groundwater for years.
This affects half a million residents living around the dumpsite. A 2007 study by UNEP that examined 328 children living close to the dumpsite uncovered that half had blood lead levels equal to or exceeding the poisoning threshold of 10 micrograms per deciliter of blood. Exposure to such high levels of lead is linked with damage to the nervous system and the brain.

The-uncollected-waste is either; illegally-dumped, or found on the-roadside, dark-corners, or disposed-off, via burning (Henry et al., 2005). In-addition-to the-Dandora-dumpsite, more-than 70 illegal-dumping-sites, were identified, most of them concentrated in-the-slums (JICA, 2016); and receive mixed-wastes of various-origins, which include: domestic, industrial, medical, and commercial and institutional-wastes.

According to Monyoncho (2013), the-percentage of solid-waste, that is recovered, by the-municipality, in-Nairobi, is only about 8% of the-recyclables, and 5% of the-compostable, while private-sector-participation is un-regulated, with private-companies operating in-open-competition with-each-other, purely on a 'willing-buyer-willing-seller' basis. Inorganic-waste-network, in-Nairobi, is comprised of licensed-waste-dealers, who buy, from large-groups of unregistered-individual-waste-pickers and neighborhood-based itinerant-waste-traders, who sell, in-bulk, to-large-scale waste-recyclers (Baud et al, 2004). According-to Karanja et al. (2005), waste-picking, in-Nairobi, is split-into: (i) street-picking, mainly, in small-open-waste-sites, streets, and dustbins; and (ii) waste-dump-pickers, who operate at-large formal or informal-dumpsites, mainly Dandora-dumpsite. At the-Dandora-dumpsite, alone, there are over 2000 pickers and dealers, earning-a-living, from the-recovery, and sell of recyclables (Karanja et al., 2005). For-example, the-Basel-Convention Regional-Centre (2007), estimated earned income, earned by waste-scavengers, is at around USD 130. Over 20% of waste-pickers/handlers do reside, at the-dump, itself, as there is a-lot of competition, manifesting in-regular-fights, on who is going to-sort-out newly-arrived, to-the-dump, waste-truck (Kasozi & von Blottnitz, 2010), meaning that it-is-better to-be there (at the-dump) all the-time.

Thompson (2010) defines ‘controlled-dumping’ as the-use of landfills, as terminal-ends-for refuse; controlled-dumping-presumes soil-cover, of the-waste, at the-end of each-day. In-most-dumpsites, in-kenya, however, this is not practiced; sanitary-landfills, or engineered-terminal end-sites, for waste-deposition are non-existent, in-Nairobi, and in-whole-kenya, as-well. Besides, there is, frequently, no mechanical-equipment, for spreading and compaction, of waste, which means little-reduction in waste-volumes. Fly and rodent-control are, often, neglected, and there are serious-problems with widespread-littering (Mensah et al., 2005). Such-method of disposal has various-negative-impacts, which include severe-health-impacts, mostly to-communities, living in-the-vicinity of the-dump-site (Wakjira, 2007), as-well-as to waste-handlers, involved.

2.4. Effects of uncontrolled-dumping

“Every day around the world…illnesses related to water supply, waste disposal, and garbage kill 30,000 people and constitute 75 percent of the illnesses that afflict humanity” (Davis, 2006).

In-particular: ‘The occupational health risks to waste pickers in developing countries are high because of manual handling and lack of protective clothing/equipment’, exposing the-waste-handlers to-the-hazardous/toxic-elements, present in-the-waste, directly-affecting their-health. For-example, Mexico-City dumpsite-scavengers were reported to-have a much-shorter-life-expectancy of 39 years, in-comparison-with that of the-general-population of 67 years (Medina, 2002). Besides, the-poorest, in-urban-areas, do suffer-the-most, from life-threatening-consequences of neglected-SW (Thompson, 2010; EPD, 2006; UNEP-IETC, 1996). Moreover: ‘Children are at greater risk from environmental hazards because of their physical size, immature-organs, metabolic-rate, behaviors, natural-curiosity, and lack of knowledge’ (UNICEF/WHO, 2013). For-example, in-Bangalore, India, an-epidemiological-survey on child-waste-pickers, at uncontrolled-landfill/dumpsite showed, that the-incidences of parasitosis, scabies, bronchial-disease, digestive-disease, and lympho-adenoma, were significantly-higher, than that for other-children, in the-city. In-the-same-accord, health-data of UN-Habitat (2009) shows higher-rates of diarrhea and acute-respiratory-infections, for children living in-vicinity of dumpsites.

NEMA, (2015), declared that in-kenya: ‘Despite the existence of laws and policies guiding waste management, weak implementation and poor practices have led to towns and cities being overwhelmed by their own waste, consequently affecting public health and the environment’. Uncontrolled-dumping is directly-affecting-the-health, of the-waste-handlers, as-well-as, people, who-live near-dumping-sites. In-addition, heaps of garbage, everywhere, create visual-pollution, and an-environmental-pollution of all-environmental-medium (air, water, and soil), furthermore, contributing to Global-warming.

Public-health-impacts, of uncontrolled-waste-disposal include: (1) diarrhea, typhoid, and gastroenteritis, from direct-contact with waste; (2) respiratory-diseases and dioxin-poisoning, linked to-open-air-burning of waste, fine-particulates (including black-carbon) and complex-organic-compounds (including both; carcinogenic and persistent-organic-pollutants (POPs)), which are highly-damaging globally and locally; (3) infectious-outbreaks and spread of vector-borne-diseases (malaria, cholera, dengue-fever), when drains are blocked, by waste; (4) flooding; (5) risks-to animals-feeding and hazardous-substances entering the-food-chain; and (6)
health-impacts from uncontrolled hazardous waste disposal (see UNEP & ISWA, 2015; ISWA, 2015; Sankoh et al., 2013; Chatham-Stephens et al., 2013; Afon, 2012; Binion & Gutberlet, 2012; Nkwocha et al., 2011; UNEP/DTIE, 2010; Baabereyir, 2009; UNEP, 2007). Besides, it is important to note, that contaminated-dumpsites can continue-to-be a health problem, long-after they have-stopped receiving waste.

Environmental-pollution, include: (1) surface, groundwater, and marine-contamination; (2) greenhouse-gas-emissions; (3) impacts on fisheries and agriculture; (4) loss of biodiversity and amenity-losses, to-residents; and (5) impacts on tourism (see UNEP & ISWA, 2015; ISWA, 2015; Phillips & Thorne, 2011; UNDP/GEF/SPREP, 2006; UNEP, 2005).

3. Discussion.
3.1.1. The-Kenyan-laws, relevant-to SWM.

The-Kenyan-laws, relevant-to SWM (highlighted in-section 2.2), are presented, in-Figure 2, in the-chronology-format/milestone-summary.

Besides, recent-review, of SWM-policies, in-Kenya, by UARK (2016), has identified the-following six-categories-sources of SWM-policies, in-Kenya: (1) Generic-policies, that provide broad provisions (e.g., Constitution of Kenya); (2) Integrated-policies, that address many-environmental issues (e.g., Environmental Management and Coordination Act, Environmental Policy); (3) Sector-specific-Acts (e.g., Public-Health-Act, Factories-Act); (4) Issue-specific-regulations (e.g., Water quality-regulations, Waste-management-regulation); (5) Solid-Waste-Management (stand-alone) policies (e.g., National-SWM-Strategy); and (6) External-policies (global and regional-policies), endorsed by-the-country.

![Figure 2: Chronological-view of Kenyan-environmental-laws, relevant to SWM.](image-url)


In-addition, the-following draft regulations, are currently, under-development or approval: (i) Draft Chemicals-management-Regulations, finalized awaiting the-due-process of promulgation, is in-accord-with the-Rotterdam, Stockholm, Montreal, and Minamata-Convention on Mercury; (ii) E-waste-management regulations developed (awaiting promulgation); (iii) Asbestos-handling and disposal-guidelines developed; (iv) Regulations on used-oil, and plastic-wastes, are being developed; and (v) End of life tires regulation (awaiting promulgation).

Besides, Policies and guiding-principles, that direct organizational-goals and objectives, on-various HCW-issues, include: (a) National-Policy on injection-safety and Medical-waste- management; (b) National-Health-Care Waste-Management-plan (2008-2012); (c) National-Health-Care Waste-Management-Guidelines, 2011; (d) Infection-Prevention and Control-Policy; and (e) Infection- Prevention and Control-guidelines.

On-examination of the-chronological- and context-development of SWM-laws, in-the-country, UARK (2016), concluded that: ‘There is a magnificent shift from focusing criminalizing offences to promoting Good-practices; from generic-Acts to specific-ones; and from centralized-mandates to more Decentralized-responsibilities’. In-the-same-accord, Haregu et al. (2017), pointed-out, that there has been a-shift, in-the-main-focus, in-the-development of SWM-policies, in-Kenya. For-example: (1) the-first-document--the-Penal Code (1948), is focused on “what not to do”, regarding SWM; (2) Next, the-Local Government-Act (1998) focused on “who will control” SWM-activities, vesting powers to responsible- bodies; (3) The-main-environmental-law--EMCA (1999), and its-regulations, incorporated stipulations on “what needs to be done” to-address the-problem of SWM; and (4) The-more-recent policy documents emphasize “how to manage/address” the-challenges of SWM.

After the-examination of the-national-SWM-laws, it-is in-order to-look at the-devolution of SWM-policy-frameworks to-county-levels (so-called by-laws). As-expected, the-capital-city-Nairobi (a-county, in-itself), is more-advanced, in-this-area, than other-Kenyan-regions. For-example, the-first-set of City of Nairobi by-laws, that address SWM, emerged in-the-1950s and 1960s. These included by-laws on Nursing-Homes and Maternity-Homes (1950); and on Restaurants, Eating-Houses and Snack-Bars (1961); General-Nuisance by-Laws (1960); and Part II of the-City-Council of Nairobi-Conservancy By-Laws (1961). The-next-set of Nairobi-City-County by-laws were published between 2006 and 2007, and included by-laws on medical-facilities (2006); banning polythene-bags (2007); wastewater-conservancy (2007); and more-general-nuisance and SWM by-laws (2007), City-Council of Nairobi (2007); A-comprehensive plastic waste management strategy for the City of Nairobi (2006); The Nairobi Metro 2030 Strategy (2008); The City of Nairobi’s Integrated Solid Waste Management Plan (2010-2020); The-Nairobi-City-County Solid Waste Management Bill (2014). Besides, in-the-coast, the-Municipal-Council of Mombasa issued its-first Environmental-Management by-laws, in-2008. Besides the-county-specific SWM-policy-frameworks, for Nairobi and Mombasa, there are additional-generic-policies with policy-content, primarily-relevant to cities and urban-areas. Among these is the Urban Areas and Cities Act (2011), which requires cities to-have the-ability to-effectively-manage and dispose of waste (Civil-Society-Urban Development-Program (2011), and the County Government Act (2013)), which identifies SWM as a-devolved-service, under each-county-government, and assigns to-it the-specific-task of implementing nationwide-policies, within its-jurisdiction (Republic of Kenya, 2013). For-more-details, on-the-evolution of SWM policy-architecture, at country-level (Nairobi and Mombasa), see Haregu et al., (2017).

With-regard to-the-implementation of the-listed-above by-laws, according-to NEMA (2015): ‘Solid waste management remains a major challenge in all the 47 counties in the country. Over the years most local authorities did not prioritize the establishment of proper waste management systems and hence the County Governments have inherited this state of affairs’.

In-the-author’s opinion, the-overall-evolvement, of the-SWM-policy-architecture, in-Kenya, seems to-be well-informed, by-the-global-policy-dynamics, in-environment and waste-management. According to Haregu et al. (2017), however, apart from preliminary-linkage, through closeness of time, of development and endorsement, of the-policies, there is no concrete and direct-evidence, about this-influence.

After examination of the-policies, relevant to SWM, it-is logical to-analyze the-bodies, responsible for the-policy-implementation. Next-section, therefore, details the-main-administrative, regulative, research, and capacity-building-bodies/organizations, which play a-significant-role in the-development and operations of the-waste-sector.

3.1.2. Coordination-institutions and mechanisms, for SWM-policies-implementation.

The-institutional-mechanisms, for the-implementation of the-SWM-policies, have also evolved, through several-developmental-stages. Before 1990, the-two main-institutional-mechanisms were: (i) local authorities (municipal/urban/town-councils); and (ii) public-prosecutors (for the-Penal-Code). Between 1990 and 2010, additional-institutional-mechanisms were-established, including: the-National Environmental Management-Authority (NEMA), National-Environment-Council, Provincial and District Environment-Committees, and Public-Complaints-Committee. In-the-post-2010 period, other-institutions were-added: the-Environmental and Land-Court; Land, physical planning and environmental-departments (country-level); National-ministries of environment and health; County governments; and the-Kenya-National-Cleaner-Production-Centre. More-details on-the-institutional-mechanism, with description and responsibilities, can be viewed via Haregu et al. (2017). On-the-other-hand, the-roles of private-sector-actors in the WM-cycle, are however, not clearly-outlined, in-the-major policies (Haregu et al., 2017).

In-particular, the-current-major-institutions, in-charge-of environmental-protection and management, in-Kenya, are:
Ministry of Environment and Natural-Resources (MENR) - is the-government-agency, charged-with principal responsibility of protecting Kenya’s environmental-resources. The-MENR also has overall-responsibility for coordinating the-work of all Lead-Agencies, whose work, directly-impacts on-environment, through the-National-Environment Management-Authority (NEMA). Specific responsibilities, for the-ministry, are to-initiate environmental-policies; coordinate the-activities of sectorial agencies; and advise government on-environmental-issues;

National-Environment Management-Authority (NEMA) - was established under the Environmental Management and Coordination-Act (EMCA) No. 8 of 1999, as the-principal-instrument, of the-government, in-the implementation of all-policies, relating to-the-environment. NEMA has the-mandate to: safeguard, restore, and enhance the-quality of the-environment, through coordination and supervision, of stakeholders, for sustainable-development; e.g., exercise general-supervision and coordination, over all-matters, relating to-the-environment, and implementation of environmental-law; and supervise and coordinate all-environmental-matters and implement all policies, relating to-the-environment, for sustainable-development;

Ministry of Health (MOH): With-specific-reference to the-Health-Care Waste-Management (HCWM) related-activities, the-missions of MOH are: (i) to-establish systems and infrastructure on waste-management; (ii) to-identify provisions of HCW-management equipment, materials, and supplies, to-health-facilities; (iii) to-develop and disseminate standards and guidelines, on HCW-management; (iv) to-promote continuing-professional- development, for health-workers on HCW-management; (v) to-train HCW-handlers, on proper-waste- management; and (vi) to-promote the-segregation, storage, collection, pre-treatment, transportation and proper disposal of such-waste;

County and District-Level Institutions: The-national-institutions, established under the-new Constitution, are required to-decentralize their-functions, by establishing County and District-Officers. Existing-institutions already-have a-presence in the-Counties, and have, or are in-the-process of establishing-offices, in-the-new-Districts. The-Constitution of Kenya (2010) creates an ambitious County-Government-structure, based on principles of democracy, revenue-reliability, gender-equity, accountability, and citizen-participation. The-roles allocated to the- County-governments include: the-implementation of national-policies, on environment and natural-resources (including soil and water-conservation, and forestry) and local-tourism, among others;

District Environmental-Committees: The-EMCA also-mandated the-creation of several-institutions, at national, county, and district-levels, to-facilitate the-fulfillment of its-functions. The-District Environment Committee (DEC) is responsible for the-proper-management of the-environment, in-the Districts. They develop the-environment-action-plans, of their-districts, and pass them-on to the-National Environmental-Action-Plan Committee; In-addition:

Kenya-Institute for Public-Policy-Research and Analysis (KIPPRA) has carried-out a-number of studies, in the-above-named-areas. Of special-relevance, to-this research is the-one on the-use of economic-instruments for MSWM, in-Kenya (Bahri, 2005); and

Kenya-National Cleaner-Production-Centre (KN CPC) is an-autonomous non-profit-institution, established in-July, 2000, as-a-project of the-UNIDO and the-Kenya Industrial-Research and Development-Institute (KIRDI). The-Centre is mandated to-build national-capacity in preventive environmental-management-tools, through a-number-approaches, comprising, among-others: technical support, policy-advice, and cleaner-technology-transfer. One of the ‘priority sub-sectors’ ear-marked by the-Centre, for cleaner-production-strategy and implementation, is the-plastic-industry (KN CPC, 2004).

The-enforcement of the-provisions governing the-SWM, is done, mainly, by NEMA and the-City Councils/Local-governments. Their-main-responsibilities, as-regards SWM, are: (a) provision of services for collection, transportation, treatment, and disposal; (b) regulating and monitoring the-activities of SW-generators; (c) regulation and monitoring of private-companies, engaged in SWM-activities; (d) formulation and enforcement of relevant-laws and regulations; and (e) formulation and implementation of MSW-policies (CCN, 2005).

3.1.3. Analysis of actors, involved in-actual-MSWM-service-delivery.
In-most-developed-countries/cities, the-key-actors, involved in-MSWM, are mostly-limited-to the municipality, and the-private-sector, where both; have clearly-defined-roles and responsibilities (World- Vision-International, 2015). In-contrast, there can be a-very-large-range of actors, involved in MSWM, in-developing-counties/cities. For-example, Figure 3 illustrates the-range of actors, involved in-WM, in some-contexts, alongside-with their-responsibilities/usual-activities.
Figure 3: Network of actors and responsibilities, in SWM (World-Vision-International, 2015).

This figure clearly illustrates the complexities, and potential ambiguities, regarding responsibility of the actors involved. One wise idiom/proverb said: ‘Too many cooks spoil the broth’, is appropriate in this case. According to the World-Vision-International (2015), the main consequence of this complexity and lack of coordination, are high levels of inefficiency, limited value addition to the waste chain, and inequalities of service, within urban communities. In this regard, it would be beneficial to restructure/lean-up the current system (with numerous actors), involved, in MSWM, in the country.

Next section will look at the challenges, experienced, to deliver efficient MSWM, in the country.

3.1.4 Challenges in the implementation of the SWM policies.

The above analysis, of the Kenyan laws and by-laws, relevant to MSWM, justified, that Kenya has indeed developed and enacted a sufficient number of policies and legal provisions, as well as created institutions and systems, at different levels of governance. This conclusion is in accord with Sibanda et al., (2017), that: “In Kenya, there is sufficient and dynamic legislation, existing by-laws, policies, and programs, regarding waste management”.

On the other hand, NEMA (2006) concluded, that: ‘Existing solid waste management policies clearly state the policy directions in terms of the required outcomes. But explicit articulation of policy strategies and implementation mechanisms is insufficient’. Besides, National Environment Policy (2013) stated, that:

Many sectoral policies and laws [on the environment], are not harmonized with each other and with the Constitution. … In addition, weak enforcement of laws and weak implementation of policies remain a major issue of concern in Kenya’s environment sector.

According to Haregu et al. (2017), the legislative and regulatory context, for SWM, is dispersed, fragmented, and incomplete, and so does not tend to facilitate the formation of cross-sectoral partnerships.

Furthermore Haregu et al. (2017) criticized, that: (1) “Despite the range of SWM policies developed in Kenya over the last decades, the problems with SWM remain a critical concern”, as “The gap between policy and adequate action remains very large”; (2) “…the emphasis has been more on ecological issues, such as cleanliness of the environment, than environmental health outcomes”; (3) “…policies give little indication of how solid wastes can best be used as resources to drive economic development that is compatible with the health of the population and the environment”; and (4) “…the model of public–private partnership, that should be applied for the management of solid waste in Kenya is not clear from the reviewed policy frameworks”.

In the same accord, UARK (2016), identified the causes of this policy-practice gap, including the following: (i) policy-making processes highly driven by government, in a top-down approach, with limited participation and ownership, by the public and private sectors; (ii) the deep-rooted attitude of considering solid waste, as a problem, rather than a resource, which could be recycled and used; and (iii) lack of infrastructure, to recycle solid wastes. In addition, Henry et al., (2006), pointed out that local authorities lack the capacity to implement the relevant laws by-laws. With regard to consideration of waste as a resource, according to Ferrara et al. (2008), recycling and composting are an accessible way to empower communities, generate income, and provide an excellent opportunity for initiating waste-minimization programs. Besides, such methods can reduce environmental pollution. Makopa, (2006), however, pointed out, that: (1) there are: “No clear policies that support urban agriculture and the use of compost in farming, unlike that of using fertilizers”; (2) there is no mention of compost in any legislation, moreover in the Public Health Act, manure is listed as a nuisance; and (3) the Nairobi City-Council has never integrated compost making into its SWM activities.

Haregu et al. (2017), also stated, that: ‘SWM remains a critical concern and a major challenge … as a result of weak institutional structures and capacity, weak enforcement of regulatory frameworks, and the control of the sector by criminal cartels’. Poor coordination, between numerous- institutions and agencies, dealing with
the-issues, of environmental-protection, and the-implementation of adopted-regulations and laws, was also-cited by Obradovi et al., (2014). According-to Guerrero et al. (2013); Nyandika (2007); and Mogaka (2006), the-problems in-implementation, is due-to: lack of vigilance and enforcement; lenient-penalties; corruption; political-interference; lack of motivation to-comply; as-well-as inefficient-prosecution-system. In-addition, lack of public-commitment and awareness, and poor-financing were cited by McAllister (2015); and Okot-Okumu (2012).

A-straightforward, transparent, unambiguous, legal and regulatory-framework, including functioning-inspection and enforcement-procedures, at the-national, provincial, and local-levels, is essential to the-proper-functioning of MSW-strategies (Marshall & Farahbakhsh, 2013). On-the-other-hand, an-interview, with NEMA-officials established, that the-authority is currently severely-understaffed, having only 10 inspectors, hence, NEMA finds it difficult to-send its-inspectors to-the-field, regularly, as required by the-law. The-City-Council of Nairobi, on-the-other-hand, finds it difficult to-enforce its-by-Laws, since it acts as a-regulator and a-service-provider, at-the-same-time (Haregu et al., 2017).

In-addition to-the-poor-policy-implementation, Baabereyir (2009), cites that the-City’s inability to-implement existing-bylaws, on waste-disposal, results in a ‘throw-it-where-you-like’ attitude (for-example: throwing waste from-the-windows, of moving-cars, busses, trains, etc., is a-norm, in-Kenya), pointing at general-disregard of waste-disposal-regulations. This is also pointing-out on archaic-attitudes and erroneous-behaviors, towards waste, by-majority of its-citizens.

In-the-face of growing MSW-generation, in-Nairobi-city, due, partly-to rapid-urbanization, the-Nairobi-City-Council (NCC)-by-laws, have-been rendered outdated, and too-weak, in-their-penalty, to-det-offenders (Nema News, 2005). Although NCC-by-laws prohibit illegal-disposal of waste, specify storage and collection-responsibilities, for SW-generators, and indicate the-Council’s right-to-collect MSWM-charges, all of these are not adequately-implemented (Ng’era, 2014; Rotich & Zhao, 2005; UNEP, 2004).

On-the-other-hand, implementation of some-policies can create new/emerging-problems/hazards, never experienced before; next-section provides one-such-example.


With-regard-to-policy-implementation, and in-particular, on-the-latest-ban on-plastic-bags, 2017, the-researcher observed, several, and in-different-areas of Kenya, that street-food vendors, do package their-food, for customers, using old-newspapers, due-to the-recent-ban on-plastic-bags, 2017. These-products include: popular-cut-vegetables ’sukuma-wiki’; fruits, fried and boiled-maize, fried-sausages and fish, and even, chips, among-other-food-stuff.

Such-practice is potentially-dangerous, to the-customers (Contér et al., 2012; Scott, 2003). For-example, Zhou et al. (2012) stated that foods, contaminated by newspaper-ink, raise specific-health concerns, due-to the-multiple-bioactive-materials, present in-inks, with known-negative health-effects. Naphthylamine and aromatic-hydrocarbons are the-major-concerns (Zhou & Stanley, 2011) of lung-cancer, and bladder-cancer (Konety & Carroll, 2008), with significantly-higher-risk for bladder-cancer, in-men (Al-Zoughool et al., 2006). Besides, since the-complex-mixture of chemicals, from newspaper-ink can-contain both; CYP1A-inhibitors and AhR-agonists, the-exposure to-such an-extract, on a-chronic-basis, could-lead to AhR-dependent-toxicity (Bohonowych et al., 2008). The-direct-contact, between the-food and the-newspaper, increases the-risk of newspaper-ink and chemicals, being-absorbed by-the-food, if the-food is hot, and if it-is fried; the-cooking-oil (lipid) acts as a-good-medium, for the-transfer of ink-ingredients (Redmond & Griffith, 2003).

The-above-account exposed that the-harm of using newspapers, as packaging material, is apparent. On-the-other-hand, it seems that enforcement of the-plastic-ban, in-the-country, was initiated without providing several-affordable-alternatives, to-plastic-bags, particularly for street-vendors. In-the-view, of the-above-narrative, the-study on-the-prevalence of use of newspaper as-packaging-material, for food-stuff, should-be conducted.

To-address the-above-mentioned-challenges, in-implementation of SWM-laws and by-laws, as-well-as challenges, in actual-MSWM-service-delivery, the-following-sections will provide some-details on the-capacity-development and governance-issues, in-SWM.

Developing-countries, and Kenya, in-particular, require assistance, in-order-to mobilize their-own capacity, to-deal with their-own-situation, which is referred-to-as ’capacity-development’ (CD). The-next-section provides CD-details.

3.2. Capacity-development.

The-UNDP defines CD as the-process, by-which, individuals, organizations, institutions, and societies, develop ‘abilities’ (individually and collectively) to-perform-functions, solve-problems, and set and achieve-objectives. This-is a-widely-used-concept, although the-definition of CD varies-slightly, from-donor to-donor. The-approaches of conventional-development-assistance and cooperation-programs, for urban waste-problems, in-developing-countries, can be classified into the-following-three-categories: (1) Hardware-approach (since the 1970s): input of equipment and other hardware as a part of urban-environmental-improvement. This approach...
based on the supply of ‘hardware’ does not have a lasting effect in terms of overseas development assistance unless it is accompanied by an appropriate scheme for the development of technical skills and a management system; (2) **Software-approach (since the late 1980s)**: assistance in the-planning of solid waste management system and emphasis on input of non-physical The success of an approach based on the software or operational expertise depends on the capacity and level of ownership of the recipient; and (3) **Capacity development approach (since the 1990s)**: assistance for capacity-development (that can be divided into two-steps of flow, namely, assistance-to building-up organizations and systems-institution-development, in the-narrow-sense, and emphasis on recipient's initiatives and social-aspect). In other-words, it is-an approach, in-which the-first-step is to-help-improve the-capacity, and then to-develop the-physical and non-physical-types of assistance, in a-comprehensive way, and in-accordance-with the-recipient's resulting-capacity.

According to JICA (2009), in-the-last 10 years, the-capacity-development assistance, has been the-mainstream of international-trend.

On-the-other-hand, there is a-considerable-body of scientific and professional-literature on-technologies, necessary for waste-collection and waste-disposal (see for-example: Coffey & Coad, 2010; Rushbrook & Pugh, 1999; Daniel, 1996; McBean et al., 1995), where WM is considered in-engineering terms, as a-technical-problem with a-technical-solution. No technology, on its-own, however, can solve the-problems, related to sustainability of WM-activities; the-governance-aspects of the-necessary actions need to-be-duly considered.

### 3.3. Good-governance in SWM

Figure 6 distinguishes, between the-physical-components (the ‘What’ dimension of a-SWM-system), and the-governance (the ‘How’ and the ‘Who’ dimensions of a-SWM-system). Besides, the-state of WM, in a-city/town can be used as an-indicator to-monitor the-success of good-governance-programs (Whiteman et al., 2001). For-example: where WM is working-well, it is-likely, that the-city has also tackled underlying issues, relating to-management-structures, contracting-procedures, labor-practices, accounting, cost-recovery, and corruption, among-others. The 3-categories of policy-instruments/Key-governance-aspects, adopted in-this-paper, are presented, in-Table 2.

**Table 2: Key-governance-aspects of extending waste collection to all and securing-controlled-disposal**

<table>
<thead>
<tr>
<th>Class of Policy Instruments</th>
<th>Goal 1: Waste Collection to All</th>
<th>Goal 2: Controlled Disposal</th>
<th>Necessary Condition</th>
<th>Enabling/Facilitating Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct regulation</td>
<td>Legal framework for inclusion of both public and private, and both formal and informal, service providers</td>
<td>Strong requirements controlling to protect the environment, and consistent and credible enforcement</td>
<td>Construction of facilities in parallel to the regulations</td>
<td>Institutional capacities to both enforce law and to work with various service providers</td>
</tr>
<tr>
<td>Economic instruments</td>
<td>Sustainable financing—securing funding for collection services, including some contribution from direct charges</td>
<td>Sustainable financing—securing funding for facilities, both capital costs and the continuing costs of operation</td>
<td>Affordability for service users</td>
<td>Availability of national and/or international funding, including EPR</td>
</tr>
<tr>
<td>Social instruments</td>
<td>Awareness raising for behavior change and clear instructions on new services, to avoid dumping and be willing to pay</td>
<td>Awareness raising for behavior change, to avoid dumping</td>
<td>Collaboration with civil society including media</td>
<td>Authorities engaging with the public and leading by example</td>
</tr>
</tbody>
</table>

**Key:** I EPR—Extended Producer Responsibility; Source: Rodi’c & Wilson (2017).

Besides, Bemelmans-Videc et al. also group policy-instruments into 3-equivalent-categories, namely ‘sticks’ (for direct-regulation), ‘carrots’ (for economic-instruments), and ‘sermons’ (representing communication and information-based-instruments). Other-authors do not explicitly classify policy-instruments (Finnveden et al., 2013).

It-is-important and beneficial, to-ensure coherence of policy-goals and cohesion, among the-instruments, applied to-achieve-them (Nilsson et al., 2012; Howlett & Rayner, 2007).

The-following-sections elaborate on each of the-instruments, in-the-above-Table.

#### 3.3.1. Direct-regulation for MSWM

Table 2 shows that there should be an-inclusion of public, private, formal and informal SWM-service providers. Public-private partnership (PPPs) or Private-sector-participation (PSP) is being-promoted in the-SWM-sector, either as an-option to-complement public-services, or to-increase the-efficiency of service-delivery. It is
seen, by the-World-Bank and European-Bank for Reconstruction and Development (EBRD), as a-key-component of the-institutional-arrangements in-SWM-service-delivery (Wilson, 2007).

Advantages of PPP include: (i) The-private-sector can provide a-more-efficient, or cost-effective-service, because it-is under-the-pressure, of market-forces, to-achieve profitability, and pay greater-attention-to customer-satisfaction; (ii) The-private-sector often has-better-access to capital financing; and (iii) The-private-sector may have easier-access-to specialist-skills/expertise. The-evidence shows, however, (UN-HABITAT, 2010) that the-waste-collection-coverage, and quality of services, are not necessarily related to-the-type of service-provider (public or private).

Besides, in-some-cases, where city-authorities failed-to-provide adequate-services, other-actors took-the-initiative, and organized services, in-their-neighborhoods themselves, either as an-enterprise or a-cooperative. Community-based solid-waste-management (CBSWM) is-the-approach, whereby members of a-community, themselves, manage such-activities-as waste-collection, resource-recovery (e.g., composting), and sale of recycled-products. Examples include educated, but unemployed-youth in-Mombasa, Kenya, provided the-much-needed-services, in-the-area, and also-managed to-create jobs, and a-source of income for themselves (Rodic & Wilson, 2017). According to JIKA (2016), this-approach is currently attracting much-attention of donors.

In-addition, a-micro and small-enterprise (MSE) can take the-form of a-small-private-enterprise, cooperative, community-based-enterprise, or labor-contract, by a-group, or social-organization. MSEs, however, cannot provide large-scales-services or take-advantage of economies of scale. Despite these-limitations, MSEs have the-following-advantages, in-terms of the-WM-business-aspects: (i) MSEs can provide services at a-low-cost, due-to such-factors-as: low-capital-cost with-the-use of handcarts, etc. and lower-wages of MSE-workers, compared-with workers, hired by municipal-counterparts; (ii) Because of their-small-size, MSEs can better-cope with-different-types of housing and access-roads; (iii) Since MSEs are usually based in-the-neighborhood, they serve, they favor community-participation and control; (iv) MSEs are labor-intensive, and, thus, can create more-employment, than large-enterprises; and (v) The-involvement of a-number of MSEs creates environment of competition among them. They also-can play a-role, in-recycling-promotion, and other-public-environmental-education.

The-best-approach would be when-the-public, private, and informal-sectors, do all work-together with-the-community, to-improve SWM (Liyala 2011; Oberlin 2011; Okot-Okumu & Ngenje 2011; Tukahirwa, 2011; Chakrabrati 2009). Besides, the-World-Bank has set-out 3-key-principles, that must-be-net, for successful PPPs/PSPs, in-WM: competition, transparency, and accountability (Cointreau 2000). In-addition, the-municipality needs to-retain responsibility for providing the-service, while delegating service provision to-the-private-sector. GTZ have published a-critical-review of experiences in-PSP, in-WM, including 23 case-studies (Coad, 2005).

Currently, there is no particular-legal-framework, on inclusion of PPPs, in-SWM-activities, in-Kenya. Also, in-Table 2, it-is stated, that the-necessary-condition, for achieving the-universal waste-collection, is that construction of facilities should-be-done, in-parallel-with the-legislation. In-this-regard, dumpsites, in-Kenya, should be upgraded to sanitary-landfills, and in-parallel, the-appropriate-legislation should-be established, to streamline the-MSWM-operations.

3.3.2 Economic-instruments for MSWM. At policy-level, command and control-strategies, alongside-with economic-instruments, have been proposed, as-effective-tools, to-manage-wastes (UNEP, 2004). The-United-Nations defines economic instruments as-tools or actions, which have the-purpose of affecting the-behavior of economic-agents, by changing their-financial-incentives. Economic-instruments-can-be-grouped-into two-categories (UNEP, 2004): (i) revenue-raising instruments (licenses, user-charges); and (ii) non-revenue-instruments (performance-based management contracting, clean-neighborhood-competitions, privatization). Economic instruments can-work harmoniously-with traditional-regulatory-mechanisms, as-well-as help to-provide the-necessary-funds, for supporting sound-environmental-management-initiatives, such-as recycling and waste-disposal-facilities (UNEP, 2004).

A-number of provisions, for relevant-economic-instruments, to-address different-aspects of SWM-chain, does exist in-several-legislations, in-Kenya. Such-provisions advocate for the-employment of financial-disincentives (fine, levy, surcharges, and penalty) for non-compliance with the-provisions, governing the-proper SWM.

Economic-incentives such-as: subsidies, tax-rebates, and exercise-waiver, are also-captured in some-provisions of the-legislations, relevant to-the-SWM, such-as EMCA. For-example, Section 57(1) of the-Act empowers the-Minister for Finance to-make-proposals to-government-tax 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. The-tax, fiscal-incentives, disincentives, or fees, to-be-proposed by the-minister, are specified in-section 57(2) paragraphs (a), (b),(c) and (d) of the-Act. Another-example could-be found in-Section 10(1) of the-City-Council of Nairobi’s Solid-Waste-Management by-Laws, which mandates the-Council to-issue directions on waste-collection charges. Such-provisions could-be-used to-
discourage bad-SWM-practices, hence, promoting good-ones.

Besides, provisions on: recycling, re-use, and material-recovery, are yet to-be developed, and according to the-World-Vision-International (2015), the-few, that have-been-developed have not been implemented-successfully, due-to many-factors, such-as: lack of awareness, among the-stakeholders, about such-tools, and the-fact, that most of the-stakeholders in the SWM-sector are not usually involved in the-process of coming-up with such-economic-tools.

In-addition, there are also voluntary-economic-instruments in-existence, employed, mostly, in-the-industrial and institutional-sectors. Examples include: Certifications (such-as ISO 1400), and the-Company of the-Year Award (COYA). The-ISO 14000-standards, in-particular, are designed to-cover environmental-management-systems, environmental-auditing, environmental-performance-evaluation, environmental labeling, life-cycle-assessment, and environmental-aspects, in-production-standards. The ISO 14000 is, therefore, can-be-considered as an-economic-instrument, as when awarded to a-particular company, it makes it advantageous, in that-market. The-problem with these-economic-instruments is that they lack a-legal-barking.

At-the-implementation-level, the-barriers to-improving WM-practices, including high-capital investment, and high-operating-costs, are often governance-issues. Modern-WM, in the-developing world, is expensive, often costing USD 75 or more, per-capita, per-year (Wilson et al., 2012; Brunner & Fellner, 2007). According-to Liyala (2011), WM is poorly-financed, in-Kenya, because it-is not a-prioritized activity, in all-urban-councils. Funds, for the-operation, of the-urban-councils, are mainly from external sources (over 50 %), like the-Central-government, and donors, in-the-form of grants (which are not guaranteed). As a-result, financial-sustainability is possibly the-most-challenging-issue, for cities/towns in-developing-countries.

Securing-financial-sustainability, of the-service-provision is an-essential governance-aspect (Rodic & Wilson, 2017). Due-to the-difficulties, in-securing-funding, for WM, alternative-financing-methods can be used. Donor-funding was used, for the-capital-costs of new-landfills (for-example, in-Lusaka, Zambia), or for major-upgrading of the-existing-dumpsites (for-instance, in-Dhaka, Bangladesh) (UN-HABITAT, 2010).

Besides, funding of landfill-operations, was provided, through the-Clean Development Mechanism (CDM), introduced-under the-Kyoto-Protocol. The-CDM enabled carbon-credits, to-be-obtained, based on the-evidence of capture and use of landfill-gas. This provided an-annual ‘revolving-fund’, paid upon presenting the-evidence, which then, provided funding to the-city, for the-next year’s proper-operation, and so-on. As the-payments were-directly-related to-landfill-gas-capture, this-constituted a-direct financial incentive, for cities, in-Kenya, to-upgrade their-dumpsites to sanitary-landfills, and operate them accordingly. Currently, the-replacement (and potentially more-flexible) financing-mechanism, Nationally Appropriate-Mitigation-Actions (NAMAs), is expected to-provide similar-incentives (UNFCC-Focus).

Capital-costs are often addressed by seeking international-development-aid-funding. Foreign-aid to SWM, in-developing-countries, can be obtained through:

1) International organizations and agencies: (a) World Bank and regional development-banks, such-as: the-Inter-American Development-Bank (IDB); Asian-Development-Bank (ADB); The-European Bank for Reconstruction and Development (EBRD); Japan-Bank for International Cooperation (Yen-Loans); and The African Development-Bank (AfDB); and (b) United Nations organizations that render assistance to SWM, in-developing-countries are: World Health Organization (WHO), United Nations Environment Program (UNEP), through its International Environmental Technology Centre (IETC); United Nations Development Program (UNDP), and United Nations Centre for Human Settlements (UNCHS-Habitat);

2) Bilateral-cooperation (Multilateral donors, bilateral donors and international NGOs are independently developing cooperation out of their-respective-positions. For-example: Japan (through JICA); Germany (through GTZ); The-Netherlands (through Urban Waste Expertise Program (UWEP), and a-non-profit NGO, called WASTE); Switzerland (through Swiss Agency for Development and Cooperation (SDC), and NGO, called SKAT (Swiss Center for Development Cooperation in Technology and Management); and U. S.A. (through USAID). In-addition, to the-countries mentioned-above, Norway, Denmark, Canada, and France, extend technical-cooperation in-SWM; and

3) International-NGOs: International Solid Waste Association (ISWA); The Water, Engineering and Development Centre (WEDC)-a research and education center of UK's Loughborough University; and The Collaborative Working Group for the Promotion of Solid Waste Management in Lowand Medium-Income Countries (CWG), among-others.

It is important to-note, that development-assistance, provided by donors, should-focus-on the-provision of incentives and opportunities, while ensuring-ownership, by the-recipients. It-is also important to-note, that capacity-development, for the-foreign-aid, requires the-shift of the-perspective to ‘emphasize the recipient's own initiative’, therefore, city-Councils/town-municipalities should be proactive, in preparing justifiable-proposals for development-funding.

Moreover, most-aid-agencies will not contribute to-ongoing-operating-costs, therefore some-cost recovery have to-be-done. Waste-service-fees are just one of several-sources, used to-recover the-costs of the-SWM-
system (see Wilson et al., 2012; Rodic et al., 2010; and Scheinberg et al., 2010a). In some-cities/towns, the-
charges are deliberately kept-low (UN-HABITAT, 2010), however, if the-charges do not entirely-cover the-
costs-entailed, the-remainder is provided, from municipal-property, or a-similar tax, or from budgets, allocated by the-
national-government, the-charges therefore should-be optimum.

In addition, paid-services are classified-into 4 systems: (1) ‘specific-rate’-the-fee increases, as the-waste-
volume increases, in-this-system; (2) “pay-for-large-volume-only”- no fee charged, until certain waste-quantity is
reached, in-this-system; (3) ‘fixed-charge’- a-fixed-fee, regardless of waste-volume, in-this-system; and (4) ‘comparative-specific-fee’- waste-fee is linked to-metered electricity-consumption, in-this-system.

Benefits of switching to-paid-services, are-said-to-be: (i) reduction of waste-generation; (ii) promotion of
recycling; (iii) more-equitable cost-sharing would become a subject of discussion in case of ‘specific rate
system’; (iv) prevention of contamination by business-related urban wastes; (v) securing revenue; and (vi)
increase of people’s awareness. On the other hand, concerns are raised such as: (i) double-taxation; (ii) regressive
to-income-level; (iii) increase of illegal-dumping; and (iv) not conducive to-changing the-economic-structure of
mass-production/mass-consumption.

Appropriate-forms of funding are essential, to-secure financial-sustainability of the-SWM-services, under
the-local-conditions of affordability and willingness to-pay. In order-to-secure some-form of financial-
sustainability for the municipal-SWM-service, it is likely that direct-charges to-the-users will need to-be
supplemented by other, indirect-sources of funding. More-details on financing-models, and their-use, for
municipal-SWM, can be found in Sections 5.4 through 5.9, of the-GWMO (Wilson et al., 2015).

3.3.3. Social-instruments for SWM.

JICA-IFIC argued, that SW-problems is a-social-phenomena, closely-related-to urban and economic problems
(especially poverty). Low-standard of living (poor-pay), education (high-illiteracy levels) and the-economy (low-
GDP, per-capita), are influencing-factors, that cause low-levels of willingness to-participate in-public-
management-matters. Largely-negative-attitudes, towards waste, and some-cultural believes and habits, have
prevented public-participation, in-some-cases (see Rotich et al., 2006; Kaseva & Mbilugwe 2005; Palczynski,
2002). Therefore, in-addition-to legal, technical, and economic-aspects, the-necessary-behavioral-change, is an-
important-aspect, that requires focused-attention (Wilson et al., 2015).

The need to-increase public-awareness of, and community-participation-in, WM has been widely-
recognized; for-instance, the-World-Bank has included this-aspect in their-guidelines, for the-Mediterranean-
region (METAP, 2005), while UNICEF initiated a-national-campaign, in-Brazil, in-1999, involving Waste and
Citizenship-Forums (Dias, 2006). Mbeng et al., (2009) suggested making-awareness programs, simple and
accessible, to-change the-mindset, of urban-residents, to-perceive waste as-resource, rather than something with
no value.

Campaigns, to-raise environmental-awareness, and impart new-behaviors, can take various-forms, such-as:
(1) informative-posters; (2) educational street theatre; (3) electronic messaging services, through social media; (4)
radio-drama; (5) promotional-events. Other-social-instruments include: popularly-known ‘name and fame’ campaigns,
whereby best-performing-neighborhoods, cities, or companies/institutions are given publicity, in the-
media, public-praise, and prizes. Alternatively, ‘name and shame’ campaigns are used to-expose poor-practices.
Local-culture, customs, and habits, have to-be-taken in-consideration, when selecting the-appropriate-forms of
social-instruments (Rodic & Wilson, 2017).


4.1 SWM and SDGs.

SWM is a-crosscutting-issue, which affects and impacts, various-areas of sustainable-development, in-each of
the-three sustainability-domains: ecology, economy, and society. The-affected-areas include: living-conditions,
sanitation, public-health, marine and terrestrial-ecosystems, access to decent-jobs, as-well-as the-sustainable-use of
natural-resources. Accordingly, out of 17 Sustainable-Development-Goals (SDGs) of the-2030-Agenda, for
Sustainable-Development, adopted by the-193 UN-Member-States, in-September, 2015 (UN-SDG, 2015), at
least 12 SDGs and their-pertinent-targets, have a-direct-link to-SWM. Not being a-high-level-SDG, in-its-own-
right, could-potentially-threaten to-reduce the ‘visibility’ of SWM, as a-political-priority; however, recent
Global-Waste-Management- Outlook (GWMO), by UNEP, argued, that the-crosscutting-nature of SWM, and
its-impact on not just one, but on 12 SDGs, should only emphasize the-importance and increase the-political-
priority of SWM (Wilson et al., 2015).

In addition, SDG Target 11.6 states: “By 2030, reduce the adverse per capita environmental impact of cities,
including by paying special attention to air quality and municipal and other waste management”. SDG 6 on
water and sanitation, explicitly addresses the-problem of waste-dumping, in-its-Target 6.3: “By 2030, improve
water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and
materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse
globally”. Besides, Target 12.4 states, that: “By 2020, achieve the environmentally sound management of
chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment” (UN-SDG, 2015).

To contribute to the achievement of the SDGs, as well as the Kenyan Vision-2030, SWM in Kenya, requires overall transformation.

4.2. Overall transformation required.

The ever-increasing amount of waste, produced in Kenya, alongside its uncontrolled disposal, needs to be seen as part of unsustainable lifestyles, of its citizens, and poor MSWM practices. 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.

Kenya should focus (as a long-time objective) on the transformation of the current system/status of MWM, to sustainable waste and resource management. Wider benefits to society and the economy, from sustainable waste and resource management, are: (1) Broader benefits of a clean city; (2) Social and political consensus, and community cohesion; (3) Business benefits of resource efficiency and waste prevention; (4) Public benefits of resource efficiency and waste prevention; (5) Increased resource security; (6) Green jobs; (7) Improved livelihoods and cleaner working conditions for the informal sector; (8) Reduction in greenhouse gas (GHG) emissions from waste disposal; (9) Reduction in GHG emissions from recycling and waste prevention; (10) Reducing food waste – improving food security; (11) Reduction in air and water pollution, by transfer of contaminants to solid waste, for proper management; and (12) Energy recovery by using waste to generate energy. For more details, on each of the listed benefits, see UNEP & ISWA (2015).

In addition, according to UNEP & ISWA (2015), SWM cannot be viewed in isolation – a holistic approach is required, for residuals management, pollution control, and environmental management. Residuals include: emissions to air, generation of wastewater, and generation of waste.

The following sections detail some widely accepted best practices, as well as an innovative method of financing, for MSWM.

4.2.1. The waste hierarchy.

There is a considerable body of scientific and professional literature on technologies necessary for waste collection and waste disposal (see for example: CSIR, 2011; Coffey & Coad, 2010; Rushbrook & Pugh, 1999; Daniel, 1996; McBean et al., 1995), where WM is considered in engineering terms, as a technical problem with a technical solution. However, for better understanding, the ranking (preferences) of technologies is important.

The so-called waste hierarchy is widely accepted as a normative guide to best SWM practice (Fagan et al., 2001). The waste hierarchy takes into account the impact of the different WM options on: climate change, air quality, water quality, and resource depletion (WRAP, 2011). Figure 4 shows the waste hierarchy.

![Figure 4: The Waste Hierarchy (modified from WASTE COSMART, 2015)](image)

The most preferable option ‘prevention’ is at the top, and there is a range of other options, which should be applied, wherever possible, before the least preferable option of ‘disposal’, at the bottom. Figure 5 elaborates further on each of the options.

Besides, the waste management hierarchy, according to Lardinois & Furedy (1999) involve the following steps: (1) Prevent the creation of waste, in product design and packaging; (2) Reduce the toxicity, or negative impacts of the waste, that is generated; (3) Reuse, in their current forms the materials, recovered from the waste stream; (4) Recycle, compost, or recover, materials for use, as direct or indirect inputs to new products; (5) Recover energy, by incineration, anaerobic digestion or similar processes; and (6) Dispose of waste in an environmentally sound manner, generally in sanitary landfills.
4.2.2. Integrated-Solid-Waste-Management (ISWM).

Integrated-Solid-Waste-Management (ISWM) refers to a strategic-initiative, for the sustained-management of solid-waste, through the use of a comprehensive-integrated-format, generated through sustained, preventive, and consultative-approach, to the complementary-use of a variety of practices, to handle solid-waste, in a safe and effective manner. ISWM is a frame of reference, for designing and implementing new WM-systems, and for analyzing and optimizing existing-systems. It is based on the concept, that all aspects of a WM-system (technical and non-technical) should be analyzed together, since they are, in fact, interrelated, and developments in one area frequently affect practices, or activities, in another area (UNEP, 2009). Integrated-Solid-Waste-Management (ISWM), is also called Integrated-Waste-Management, or Sustainable-Waste-Management.

ISWM novel approach, essentially, is built upon the holistic, all-inclusive, comprehensive notion of sustainability, on multiple levels. It distinguishes between three principal dimensions, each denoted by a question, shown in Figure 6, as one side of a cube (Wilson et al., 2013): (1) What? – the scope, which includes the physical components of a waste-system, but goes much further, by identifying a number of other planning and management issues, that need to be addressed, such as: strategic planning, public participation, financial management, etc.; (2) Who? – focuses on the stakeholders or actors; and (3) How? – how strategic objectives and issues should be addressed, introduces for the first time a series of strategic aspects: political, institutional, social, financial, economic, and technical.
Figure 6: The conceptual framework for integrated municipal solid waste management, in low-income countries (Schubeler et al., 1996).

Besides, Figure 7 shows ‘Two triangles’-representation of ISWM (concept adapted from Scheinberg et al., 2010).

The left-triangle, in Figure 7, comprises the three key physical elements – linked to the key drivers for SWM (Wilson, 2007) – that all need to be addressed, for an ISWM-system, to work well and to work sustainably, over the long-term: (1) public health (linked primarily to waste collection); (2) environment (protection of the environment, throughout the waste chain, especially during treatment and disposal); and (3) 3Rs – reduce, reuse, recycle (driven by resource values and more recently by ‘closing the loop’ and returning both; materials and nutrients, to beneficial use). The right-triangle focuses on ISWM ‘software’ – the governance strategies, that all need to be addressed, to deliver a well-functioning system. The system, as a whole, needs to: (i) be inclusive, allowing stakeholders to contribute as users, providers and enablers; (ii) be financially sustainable, which means cost-effective and affordable; and (iii) rest on a base of sound institutions and proactive policies.
Besides, some of the major features of ISWM are as follows (van de Klundert & Anschütz, 2001): (1) Holistic-approach to all waste-streams, thus maximizing synergetic-benefits in: collection, recycling, treatment, and disposal; (2) Maximize the opportunities, for resource-recovery, at all stages – from generation to final-disposal; (3) Accommodate aspirations of all stakeholders – from waste-generators to waste-management and service-providers; (4) Facilitate life-cycle-view of products and materials; thus, promoting greater-resource-use-efficiency; (4) Integrate different-response-functions, such-as: technical, managerial, financial, policy, etc.; and (5) Greater local-ownership and responsibilities participation, through a consultative-approach.

According to UNEP (2009): “Despite the remaining challenges, evidence of recent improvements suggests that sustainable solid waste and resources management is feasible for developing countries”, hence it should be considered for Kenya, as a-long-time-goal.

4.2.3. Innovative-financing.
Sustainable-financing is a major- obstacle for many municipalities, in developing-countries, including Kenya, seeking to-improve its MSWM. Municipalities are caught in a vicious-cycle; they are unable to generate the necessary fee-collection-rate, until they improve service and, conversely, people are unwilling to-pay for poor-service (World-Bank, 2014). Policymakers need innovative-financing mechanisms, to-increase cost-recovery-levels, and improve service-delivery, and outcomes, in this basic and critical-sector.

One of such innovative-financing-mechanisms is Results-based-financing (RBF), for MSW, which is a financial-mechanism, through which, the-payment for solid-waste-services, is conditioned to the achievement and verification, of pre-agreed-targets. RBF focuses greater-attention on measurable outputs, in basic-service-delivery, and changes in human-behavior. RBF is to improve SW-service-delivery and fee-collection, to promote recycling and source-separation, and to strengthen waste-collection and transport, in under-served communities. In the-Kenyan-MWM-sector, which faces ever-increasing waste-generation rates, low-waste-collection, and budget-constraints, RBF appears as a valuable-tool, to-ensure that public-funds are used efficiently and transparently. Report by World-Bank (2014), presents valuable-lessons, from the custom-made-design and preparation-phase, of eight MSWM-projects, in developing countries. RBF, however, is not a panacea, for the SW-sector, and is more-efficient, when associated with other-instruments such as: infrastructure-investment, policy-reform, and technical- assistance.

5. Conclusions
The above-analysis on the legal-foundation, have justified, that Kenya, indeed, has made substantial-efforts, at the-policy-arena, to oversee, regulate, and promote good-practices, in SWM, as well as to safeguard human-health and the living-environment, from the consequences of uncontrolled-waste-disposal. The relevant-efforts, manifested by Kenya, as: (1) being a signatory, or a party-to, the main International Conventions and Treaties; (2) enacting numerous-laws and by-laws, relevant to SWM; and (3) creating institutions and systems, at different-levels of governance.

Notwithstanding the existing legal-framework, Kenyans do continue witnessing, day-after-day, an overwhelming number of cases of non-compliance, with the set-performance-standards and regulations, on SWM. It has been said, that WM is a mirror-reflection on the state of a society, itself (Kunitoshi, 2000). The reflection, of the current-Kenyan SWM scenario, is varied, between and within: (i) Rural and urban settlements; (ii) the status of the city/town (e.g. capital-city, city, town-municipality, etc.); and (iii) High-income vs. low-income-areas. This study have also exposed multi-dimensional and complex nature of the existent challenge of MSWM, in the country. In particular: only small-fraction, of the generated waste, is collected, in Kenya, and mostly dumped, or burned, in an uncontrolled manner, while hazardous toxic-waste is often mixed with non-hazardous. Beside, the principles of 3R (waste reduction, reuse, and recycle) are hardly prioritized, by the municipalities, for effective and sustainable WM. In addition, the study identified, an over-crowded, poorly-coordinated, and largely unregulated network, of actors, involved in actual SWM-service-delivery.

Moreover, widespread uncontrolled waste disposal, and open air burning, of uncollected waste, in Kenya, is directly affecting the health of the waste-handlers, as well as, people who live near the waste dumping sites. In addition to public health risks, such practices do create both environmental pollution and visual pollution. Besides, on a long run, enduring poor state of MSWM (manifesting in decomposing, smelling heaps of garbage, ubiquitously), can influence the perception of the next generation of Kenyans, that this situation is unchangeable and even normal acceptable state of affairs, and consequently, the status quo of Kenyan garbage misery, continues. Therefore, some timely changes, towards proper sustainable SWM practices, in Kenya, should be in order.

The study also points out, that the existing, in Kenya, policy framework, relevant to SWM, is probably, not a problem, in itself, the problem, rather, is in the proper implementation/enforcement, of the laws. Logically, even most progressive and dynamic laws, are worth absolutely nothing, and remained good, only on paper, if not properly-implemented. The task, therefore, remains, for the national and local governments, as well as other SWM stakeholders, to make every possible effort strictly implementing the existing laws and regulations.
This task is colossal, but it have-to-be systematically and meticulously-executed, to protect human-health and the environment; this will necessitate the capacity development in, and financial sustainability of, MSWM.

To achieve the SDGs and the Kenya Vision-2030, Kenya should also focus (as a long-time objective) on a complete transformation of the current insufficient-MWM-system, to sustainable waste and resource management. This will improve overall livability, urban resilience, cities/towns competitiveness, as well as create jobs, and provide income-generation opportunities, to local citizens. Widely accepted Waste Hierarchy, in conjunction with both, the Integrated-SWM (where waste is considered as a resource) and RBF innovative financing, should be the best option, for Kenya. One, however, needs-to-be realistic, and start with small steps, fixing initially, what is the most obvious and essential. That would be the stinking decomposing heaps, of uncollected garbage, that have remained a permanent feature, and a painful eyesore, in most parts of Kenyan urban centers.

Hence, first and foremost, proper/regular waste collection services should be offered, by providing good governance, and creating public-private partnerships (PPPs). Ambitious target of 100% waste collection, to all urban citizens (regardless of income level, and including: informal settlements, slums, and peri-urban areas), should be focused on. This is, again, a huge undertaking, for Kenya (as currently the national waste collection is only at an average of 40%), therefore, this challenge needs to be recognized, and treated, as a priority by: the national and local governments, as well as all other stakeholders, including the international community.

Secondly, to assist waste collection services becoming more sustainable, this study recommends, to consider an innovative Results-Based Financing model, in order to increase the proceeds form the collection of waste collection disposal fee. In addition, the city councils/town municipalities should use the information (provided in this paper) on the international development donors, and be proactive, in formulating justifiable proposals for the development funding, of their SWM operations. Thirdly, the current waste dumping sites should be upgraded to designed sanitary landfills; this will reduce not only environmental pollution, but also enable local authorities to obtain carbon credits, which in turn, can be converted to money, for WM operations. Lastly, widespread littering, an open air indiscriminate dumping, and burning of waste, should 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.

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