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CRAFTING A THEORETICAL FRAMEWORK ON WASTE MANAGEMENT: A CASE FOR SUSTAINABLE CITIES

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ABSTRACT: Theory formulation is crucial in search of a genuine panacea on Solid Waste Management Disposal. The study aims to catenate the different theories in Solid Waste Management to be able to re-craft a theoretical framework for Sustainable Cities. A qualitative research method was applied to consolidate and synthesize the fragmented theories on Urban Ecology, Policy Making, Eco-Innovations, Triple-Bottom Line, Waste Management and Sustainability. Formulation of policy and implementation instruments is vital tool to reinvent Waste Management Theory. Wastes disposal is a global phenomenon. As a result of theoretical analysis, urban transformation amidst economic development poses environmental degradation. Progress is inevitable, hence urban transformation occurs. The upward pressure from economic development creates downward pressure on environmental degradation. This condition when exhibited longer than necessary, stagnation proliferates and cities turned into an ecological sacrificial zone. To mitigate, formulation of policy instruments as government sticks must transpire. And at the end of the spectrum, regulations and policies embodied in the implementation instruments based on Waste Management Theory must be supported by eco-innovations. These innovations inclusive of new ideas, new behavior, processes, and products in sync in a Waste Management Program measured through environmental preservation/restoration, economic resilience, and social wellbeing commonly called as the "Triple bottom-line". Thereafter, the metamorphosis of cities from the ecological sacrifice zone into sustainable cities will transpire.

Keywords: Waste management theory, Policy making, Eco-innovations, Sustainable cities

1. INTRODUCTION

Solid Waste Management Disposal is a prevalent global concern, not solely in terms of waste-related diseases affecting living conditions, but more so from an environmental, societal, and economic aspect [1]. The world can no longer afford the time or the resources to produce and insatiably consume endless novelty and needless change [2]. There is a need to deal with multiple problems simultaneously, mindfully and synergistically. United Nation Development Programmed (UNEP) lamented that one of the central tenets of Inclusive Green Growth Programs is that, environmental friendly development can become a driver of job creation, investments and economic development [3]. These are not economically inferior to "dirtier" sustainable progress [3]. Hence we should start the journey in reinforcing the theories behind waste management.

2. THEORIES

2.1 Theory of Urban Ecology

Antrop illustrates urbanization in denoting the transformation process of a rural living condition into an urban-like lifestyle [4]. It involves a move from old-fashioned cultural environments, including informal economic and political institutions, creating relative anonymity leading to formalized societies of urban settings [4]. In contrast, Kelbaugh recognized the "Theory of Urbanism" as a controlling but neglected strategy to mitigate ecological footprint and global climate change [2,5]. The author claimed, cities become an ecological sacrifice zone that even the greenest of cities inflict local environmental wounds that nature must heal, they leave wounds in pursuit of economic development. Nevertheless, in the arena of revenue realization, Cities are generally more productive and creative per capita than rural communities [2] but they tend to have larger ecological footprint than countryside [5]. Collectively, lowering individual footprints might be more acceptable once we include social relations such as grassroots initiatives that could contribute to sustainable sources of wellbeing [6]. The Ecological Footprint of different cities are driven by socio-economic factors like infrastructure, disposable income, and cultural habits.

Drakakis-Smith reiterated the principle of sustainable development requires a triangular relationship between economic, environmental and social agents in a particular community [4]. Environmental considerations will be in terms of 'externalities', a phenomenon whereby, an individual is affected positively or negatively by the

economic activities of others [7]. These group of individuals living in the so-called modern consumer society will be in a grip kind of 'social pathology' where present patterns on consumption already threaten our quality of life, the environment, and sparingly because of failure to satisfy our needs [4]. Thus, it is with paramount interest to understand urban metabolism that identifies changes and suggests adaptive responses which when combined with public awareness can be a catalyst for economic, physical and social dimensions of the city [8].

Urban sustainability compels effective policy and planning, good governance, as well as the participation of local enterprises and residents [8]. We should not wait longer than necessary on said cities that are highly industrialized to transform its focus on widespread economic advancement with expensive environmental costs and detrimental impacts to mankind, nor to effect restoration phase before final sustainability transformation occurs where and when irreparable costs have already been inflicted [8].

Smart cities came to the scene as a potential panacea to somehow reverse or ease the impacts of ill urbanization [9]. Literature reveals three types of drivers of smart cities- community, technology and policy which are linked to five desired out-comes; productivity, accessibility, wellbeing, liveability, governance and sustainability [9]. Today, smart cities are seen as hubs of technological innovation rather than cities of sustainable development [9].

2.2 Policy Making Theory

For the next decades, urbanization will be a major challenge on the same footing, sustainable planning and resource management in cities posit an opportunity to coincide with global sustainability transition. Bettencourt et al. visualize sustainable planning requires meaningful urban metrics based on the quantitative interpretation of cities needed to help design sustainable policies and positively reinforce collective public aspirations [10]. But citizens and communities tend to resist existing policy frameworks that require to "include" them in the implementation process, not unless direct benefits can be derived. They oppose being "stuck" into a pre-arranged programs that would limit their participation to a menu of equally unacceptable options. As alternative methods and practices evolve, this is a "fitting moment to heed to socio-environmental methods and innovations forged not out of a social accord, but out of social dissensus" [6/11]. It is then through disruptions and practices of dissent by the people, that can possibly serve as living indicators of what immediately requires to be addressed and where[11].

As a connecting arm, the government can proactively recognize stages of urban transformation, promote economic growth, establish attainable goals, assign responsibilities and facilitate strategy implementation [8]. In order to achieve sustainable development, the government must establish environmental regulations and programmes for supporting financial systems and fostering eco-markets [12]. Policies once formed are implemented by means of policy instruments [12]. Vedung classified these instruments as "set of techniques used by governmental authorities to wield their power in order to ensure adherence and support" [12]. Government plays a crucial role as enforcer of policies. But significantly, according to Kamruzzamanb, Fothc and Sabatini-Marquesd, there is still a need for a post-anthropocentric approach in practice and policymaking for the transformation of truly smart and sustainable cities [13].

To reiterate, the main principle of policies on waste programs is to protect both human health and environmental condition by imposing normative behavioral consumption changes [14]. Public perceptions can pose a threat to the acceptability and compliance rate on the legal frameworks. Implementing government agencies need to positively side-track public pulse [15]. Public involvement prior to approval and implementation on said regulations can be seen as a strategy to influence perception, drive public effort, and produce legitimacy for a specific regulatory proposal [15,16].

2.3 Theory of Waste Management

The traditional waste management view is centered on assurance compliance, risks management, health and environmental protection that are short term tactical [17]. The same authors reshaped traditional waste management view into new value creation that can raise productivity, enhance relations, support eco-innovations, and enable growth for long term endeavors. But the focal point of practical waste management lies on three vital objectives; (1) waste quantification (2) waste characterization and (3) waste management methods or practices [17]. And the three waste management practices classification include: (1) prevention practices comprising strategies on waste minimization, (2) end-of-pipe strategies involves recovering the economic value on waste through waste separation, recycling, proper landfilling, incineration and (3) environmental restoration practices, aimed at repairing leakages and damages to the environment [18].

Cooper correspondingly classified improving resident's awareness and legislation as preventive

practices [17]. Hence, purportedly instrumental in the attainment of environmental and societal wellbeing as part of the two pillars of the Triple Bottom Line. In the same context, end-of-pipe strategies cover waste segregation methods that are either origin-separated collection or destination-separated collection [19]. These end-of-pipe strategies are classified as eco-innovations. And shredding their shadows on the light of economic boundaries, the prevention practices are less costly but offer the highest effectiveness rate, while environmental restorations are the most expensive yet the least effective [17].

2.4 Eco-innovation

The initial scope of eco-innovation includes in part the productions and processes, then on the improvement of the management system, the creation of new markets, material flows and social eco-innovation [12]. Eco-innovation is well-defined as "all measures of relevant actors which develop new behavior, new ideas, process and products, to apply or introduce them in the attainment of ecologically specified sustainability targets that contributes to lessen environmental burdens" [20,12]. Simply stated, eco-innovation is innovation in "any form", which is beneficial to the environment [21]. Eco-sustainability innovation includes also a social aspect that emphasizes one of the elements in the TBL which extends its scope to include institutions, markets and social actors [12]. Innovations include but not limited to the use of renewable energy technologies, green products, and pollution prevention schemes [12]. Cross-disciplinary technological trials related to eco-innovations are the furthermost precarious and problematic issues when a city or organization moves toward sustainability [20]. Effective eco-innovations lead the way towards sustainable development based on the Triple Bottom Line Sustainability [12,20].

The benefits of eco-innovation other than complying environmental regulations will also improve economic aspect, the competitiveness of companies and countries by supporting the creation of a new market for green growth products and processes, corresponding employment effects and so on [12]. Hence, the execution of multidisciplinary systems and technologies concerning eco-innovation is the road toward sustainability [21].

2.5 Triple Bottom-Line Concept

The term Triple Bottom Line (TBL) was coined in 1990s by business consultant John Elkington to describe the economic, environmental, and social value of an investment that may accrue outside a firm's financial bottom line [22,23]. TBL or sustainable economic development was defined as activities, programs or policies designed to provide or retain jobs and wealth in ways that contribute to economic, social, and environmental well-being over time [24]. It is distinct from economic growth or development, which may or may not contribute to overall well-being including fiscal health, quality of life, resource stewardship, and resilience [24]. This line of thinking suggests that economic systems exist to serve human well-being, that human and economic well-being is inextricably linked to environmental well-being, and thus, human, environmental, and economic well-being must be considered in the design and evaluation of economic development efforts [24]. By considering social, environmental, and economic factors, TBL, or sustainable economic development, provides a more meaningful, productive framework for achieving and measuring economic development [24]. Specific programs with regard to trainings, incentives, assessment, and research that can advance theory and practice are central to the success of the TBL approach.

3. SUSTAINABILITY

Ironically, although emerging countries could draw lessons from the environmental and economic failures of the 'developed' ones, many headed to trail on the same unsustainable development path [5]. But moving towards sustainability is also a social challenge that entails international and national law, urban planning, local and individual lifestyle, and ethical consumerism. The science of sustainability has emerged in the past 30 years and at its core is a holistic approach to generate "solution-oriented discipline that studies the complex relationship between nature and humankind" [25]. In 1987, the United Nations first coined the concept of sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" [20,26]. Lin emphasized the need for Ecological Footprint to track down the occurrences of biocapacity deficiency, the anthropogenic impact on ecosystem and biodiversity in order to measure sustainability.

A favorable result occurs when the National Footprint is lesser than the ability of the environment and natural resources to regenerate, there is what we call biocapacity reserve [27]. The presence of biocapacity reservation does not necessarily imply sustainability but as explained by Bastianoni and Kitzes, it is essentially the minimum condition for sustainability [27]. "harvest rates should not exceed regeneration rates, and that waste emission rates should not exceed the natural

assimilative capacities of the ecosystems into which the waste are emitted" [27].

A sustainable environment is the end product of sustainable consumption. Ajzen's theory of planned behavior considers foremost the end user's behavior in purchasing [20]. Rationality dictates the consumer's intention by considering these aspects: social norms observed behavioral control and a person's attitude. Much of the environmental glitches are due to human behavior when put into actions are called anthropogenic. Therefore, changing consumers' behavior toward sustainable consumption and green innovation [16] is a necessity for a business or successful community modeling [28]. Research studies have enunciated that a significant reduction in environmental damage is possible if users' behavioral purchases conform to environmental protection [20]. In this context, pro-environmental behavior causes minimal or no harm to the environment [20]. Businesses must innovate to respond to environmental needs while creating a product's value in ever-changing consumer's demand and lifestyle toward environmental sustainability [20,21].

Urbanism once embraced does not necessarily imply placing environmental sustainability at arm's length. Sustainable cities may seek ways to use the capabilities of disruptive technologies toward making proper changes in human behavior, on the other hand, disruptive technologies can change the behaviour of the consumer toward pro-environmental behavior. Cities require innovative, cross-industry solutions to facilitate the collection and disposal of solid waste. The solutions should be replicable, adaptable, and scalable [30]. The term 'Throw Away society' denotes a society with an exceptionally lofty consumption pattern and depletion of resources generates huge volumes of refuse [31]. The waste volumes did not only expand with a growing population but also evolved in characteristics.

Fig. 1 Theoretical Framework on Waste Management

4. RESULTS AND DISCUSSION

The study was carried out by sequential steps to collect, select, analyse, synthesize and evaluate the quality of literature. Following the instructions of Tranfield et al. and Moher et al., the development of the review involves five steps; (1) research objective definition (2) database selection (3) keyword identification (4) selection of compatible articles and (5) data extraction [29]**.** And with the help of MaxQDA software the selection of appropriate articles was made easier.

MaxQDA is a software program designed for computer-assisted qualitative and mixed methods data, text and multimedia analysis in academic, scientific, and business institutions. Using MaxQDA lexical search for "Sustainability", "Environment" and "Waste Management MaxQDA, a total of 101 peer reviewed journals published from 2014 to 2019 coming from different data bases such as EBSCO, Science Direct, Springer Nature, JSTOR, MDPI and other open access journals were analyzed. A total of 53 articles were selected out of the 101 peer reviewed articles, on the basis of having at least 20 lexical word-searched from the three word categories. The remaining 53 articles, were finally narrowed down to 30 relevant studies. These were thoroughly synthesized after qualifying on the second level lexical word search for the following variables; innovation, eco-innovation, policy formulation, policy implementation, theory(s), Triple Bottom Line and sustainable cities. The literature review facilitated the re-crafting of the Waste Management Framework.

4.1 Framework Analysis and Validation

Progress is inevitable, hence urban transformation occurs. The upward pressure from economic development creates downward pressure on environmental degradation. This condition when exhibited longer than necessary, stagnation proliferates and cities turned into an ecological sacrificial zone. To mitigate, formulation of policy instruments as government sticks must transpire. And at the end of the spectrum, regulations and policies embodied in the implementation instruments based on Waste Management Theory must be supported by eco-innovations. These innovations inclusive of new ideas, new behavior, processes, and products in sync in a Waste Management Program will facilitate the sustainable plan for smart cities. The re-crafted framework will be measured Triple Bottom Line approach. Thereafter, the metamorphosis cities from the ecological sacrificial zone into sustainable cities will transpire.

Table 1. Final Summary of Review of Related Literature (RRL) using MaxQDA Lexical Search

	Innovation	Eco-Innovation	Policy Formulation	Policy Implementation	Sustainable Cities	TBL	Theories	Total
RRL95	128	79				1	1	209
RRL93	89	59				11	22	181
RRL81	30				95		14	139
RRL70	27	70			2		3	102
RRL82	53	3			8		4	68
RRL76	10						46	56
RRL75	12				18		24	54
RRL42	43						10	53
RRL79	15			2	4		23	44
RRL69	11				9		3	23
RRL56					20		1	21
RRL91	11			1			7	19
RRL25	10	2		1			3	16
RRL12	12				3			15
RRL71	1				8		3	12
RRL14					7		3	10
RRL1	4			1		1	1	7
RRL72	1				4		2	7
RRL97	6						1	7
RRL96							6	6
RRL26	2						2	4
RRL4			2				1	3
RRL6							3	3
RRL36							2	2
RRL37	2							2
RRL88	1			1				2
RRL11							1	1
RRL13			1					1
RRL17				1				1
RRL19							1	1
RRL51							1	1
RRL59							1	1
RRL8				1				1
RRL89							1	1

5. CONCLUSION

City competitiveness is an important part of the national economy. A competitive city generates wider sources of investments and employment, not only for the benefit of the current generation but more so in securing the future of our grandchildren. Economic growth will not lead to environmental degradation in the presence of strong responsible consumption, rather it can cultivate environmental consciousness.

The inner desire to preserve the future's generation can be taken as a staggering investment in transforming urban ecology to sustainable cities. Environmental Sustainability is entrenched on pro-active policy-making theory, delivered through eco-innovations with beautifully wrapped innovative waste management program that can be quantitatively measured through Triple Bottom Line Sustainability.

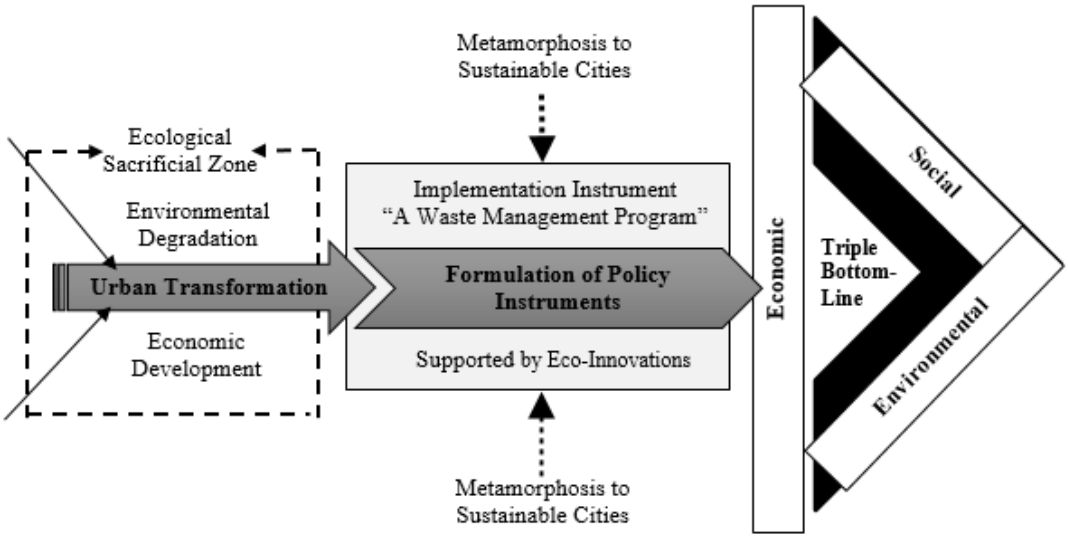

Fig. 2 Crafted Theoretical Framework on Waste Management of Sustainable Cities

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