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Wealth out of waste, Best out of waste, Cash out of trash - Review of Literature

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ABSTRACT

In the context of "Swachh Sarvekshan", the concept of waste management plays a very significant role in achieving the vision and mission of "Swachh Bharat Abhiyan", the clean mission of India. Waste on one hand can become a factor undesirable, on the other and the most important angle, can contribute significantly to the national income as it has the potential to become a great source of income if put to use through recycling and reusing. Focusing on the domestic waste, a project was taken up under the title "A Cost-Effective Prototype Solution for Finance Accountability using MATLAB-GUI for Waste Management" which formulated a cost-effective software solution using MATLAB-GUI for finance accountability during the administration of waste management at municipality level. Considering nine modules with nine parameters as one for each module the software formulated assists in calculation of revenues generated out of recycled and reused waste, in a flash of a moment. The project also provides a sample administration to the software designed to facilitate easy replication besides giving a few workable solutions for sustaining the enthusiasm of the citizens in following the procedures laid down for managing the waste effectively.

The current article reviews the available literature in the area of waste management and fund accountability. The study of this literature helped in identifying the research gap for selection of the above project and facilitated the formulation of the software solution.

Key words: *MATLAB-GUI, Finance Accountability, Review, Software Solution*

REVIEW OF LITERATURE

1 Introduction:

Review of literature uncovers all previous research done on the topic and sets the platform on which the current research is based. The literature review will help in comparing and contrasting what has been done in the historical context of the research as well as how the current research is different or original from what others have done thereby helping the researcher to rationalize why there is any need to do this particular research.

The current article begins with reviewing the literature pertaining to the problems associated with generation of waste in India with special focus on problems relating to the fund allocation issues involved in waste management. This is further supported by the literature review relating to the effective measures taken up for achieving the mission of clean India. The studies relating to the techniques adopted for effective waste management, which in turn lead to the creation of smart cities, are also reviewed subsequently. Finally, the article ends with a brief analysis of research gap found through the literature that facilitated the selection of the current research topic.

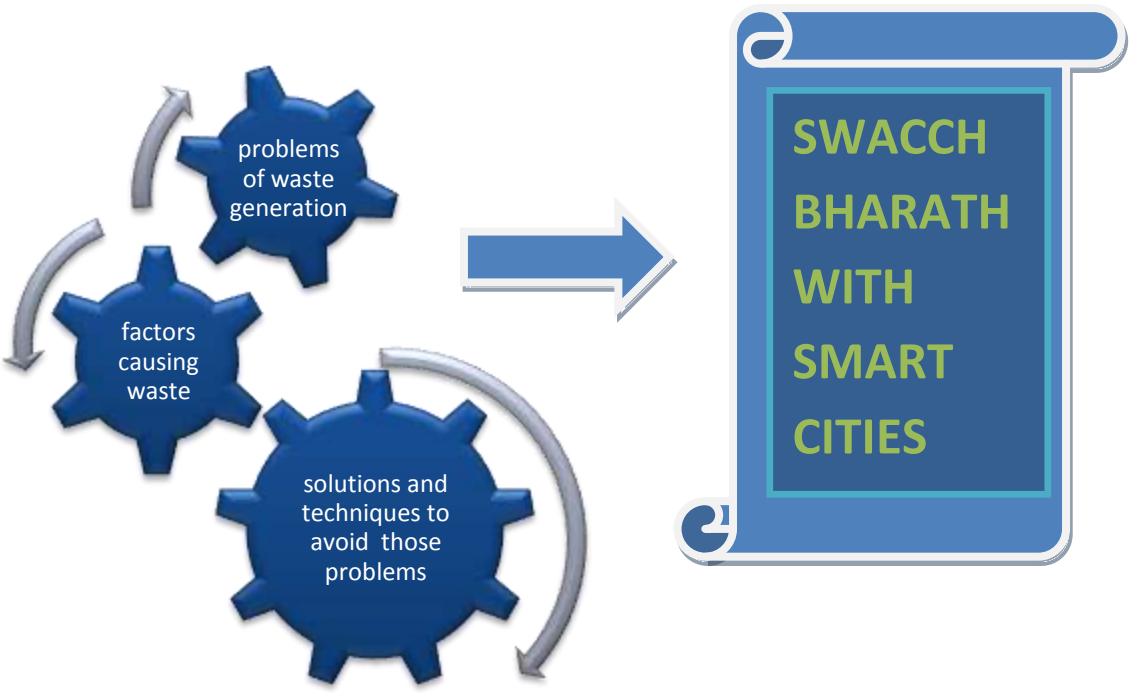

Figure: 1.1Conceptual agenda of the literature review

There are several factors that are insisting the government to take serious measures to regulate the waste generated. There are several componenets of waste that are considered to be a potential income provider. An overview of the types of wastes, different measures and practices followed in various places is discussed. Then we also discuss the reasons why the management of waste is becoming a problem. Along with different types of factors that are contributing to the increase in the waste generation it also deals with the reasons contributing to it and measures taken to control the problem of waste.

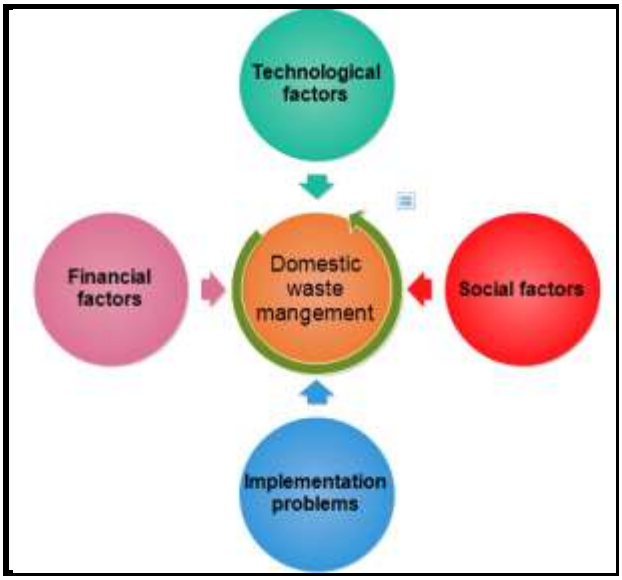

Figure: 1.2 Factors affecting Waste management

1.2 Problems associated with generation of waste in India

Waste created can cause many problems leading to hygiene problems and environmental problems. This article of kumar & pandit, (2013) studied the problems of waste in Indian cities and proposes the necessary solutions for the problems. It identified the different types of waste s generated and various stages in which it can be managed. It also states that high-income group of urban areas generates the major portion of the non-biodegradable waste whereas the small income group contributes a significant portion of the degradable waste. It also describes the problems of storage of waste at the generation itself. It states the importance of segregating the waste at the source level. It avoids the hazardous effects on the environment. Francesca et al., (2015) Studied the problems caused due to food waste and recognized a series of solutions to be executed. It states that the problem of food trash is on rise and gives sustainable solutions that can be extended to all sectors. It came up with an awakening idea of using the food waste in producing biofuels, biopolymers. Land filling and incineration became less desirable choices.

In most of the cities, the prevailing method of disposal is land filling and opens dumping which is hindering the development of smartness. It compares our techniques with those of developed countries trying to replicate. It found the problem of incineration of waste due to diversified climates in cities. It stated some of the recommendations for effective management of wastes are like cognizance of people, clear guidelines, separation of waste, location of waste disposal, privatization, etc. This study brought the problems along with `Mohan et al., (November 1998) This article deals with the various processes in India, the transportation, the collection and disposal of solid waste that are unscientific and chaotic. Unsystematic and uncontrolled ways of waste disposal is a great threat to the environment leading to serious global and environmental problems equating with the vehicular emissions at times.

Because of the unawareness in the scientific technologies in managing waste recycling is prevalent in most of the places in India. Due to this there is an advantage of the availability of low cost recycled products in the market. There are still many options left for a better management of generated trash. Afroz et al., (2011) from the obtained data on the generation of waste, characteristic features of socio-economic, and readiness of the families to segregate waste was attained from the interview discussions with 402 plaintiffs in Dhaka city. Generally, the technique of least square regression was chosen as a tool to govern the leading issues that might impact the generation of waste of the houses. The outcomes revealed that the generation of waste of the families in Dhaka city was considerably affected by domestic family size, apprehension about the atmosphere, income, and readiness to segregate the waste. These aspects are essential to efficiently advance management of waste, income, performance, and income, in addition to the reduction of environmental deprivation of the domestic waste.

Economic Times, (2016)Prices and difficulties associated with waste are enormous, if used properly in a smart way can be used as potential source of finance. Some of the key subjects connected with waste are dumping openly, particulate emission of matter, odor, leachate seepage from dumpsites and landfills, greenhouse gas (GHG) radiations that drive air pollution, and other pollutions like surface and groundwater pollution, contamination of food chain, land area exhaustion, human health effects, environmental deprivation, and undesirable effects on plant and animal lives. Morrissey & Browne, (2004) this study deals with all the models undertaken by municipality and their limitations. It focuses on all those problems of cost benefit analysis, life cycle, and decision-making. It is endeavoring to make a sustainable model for management of waste factoring in all the aspects that cause it. Unfortunately, no model factored all the aspects.

Pinka Sankoh et al., (2012) the solid waste generation has developed an amassed environmental problem and problem of public health, particularly in the currently developing nations. These difficulties related with the solid waste generation are also a part of communal fluctuations where families perform a significant part. Unvaryingly, these social fluctuations affect the magnitude, arrangement and features of given households. From the results of the Structured, questionnaires were administered in the designated electorates of the city. These are the maximum populated electorates that contributed to 70% of the entire amount of city's solid waste. So, they are appropriate samples of the study area. The degree of the generation of waste was found by using "door- to-door" method in 5 chosen households from every constituency/community through categorization and assessing of generated solid wastes respectively. The dependent variables were generation of solid waste and elements, and the independent variables were family magnitude, tutoring, levels of income amongst others. The statistics were exposed to analyze statistically to find associations between independent variables and dependent variables using correlation. The outcomes indicated that the generation of solid waste and configuration in Freetown was considerably impacted by the family size average, status of the employment, monthly drawings, and (number of room or area occupied by families. Commonly, it effectively advises new visions regarding the part of socioeconomic factors in impacting the group and configuration of domestic solid waste.

This study by Simone et al., (2001) shows the shortage of land for land filling which is the usual destination of many places. Land filling is facing the problem of increasing cost, restraining force from community etc. Since the relationship between the availability and need of land is not found this study forecasts the land need for disposal measuring .It predicts that the demand of land for waste disposal overcomes the supply before 2050.

1.3 Financial problems faced by municipalities for waste management:

There are many constraints for waste management in India. Among all those the greatest constraint is financing since the tax policies and other finances for waste management are not sufficient for the needed infrastructure. christian et al., (2014) this article emphasizes on the need of financial sustainability for effective management of waste. In Ethiopia management of waste was subcontracted to private company in turn helping private sector to make revenues. This studied the cost revenue analysis of 2009-2011. It also stated the fee structure of waste collection from different sectors of country. It came up with 4 varied options of management of waste with sustained financial stability in a place called Bahir Dar a tough association is built between the municipality and the private sector for improvised management of waste.

1.4 Measures for clean India:

Mehrotra, (2015)India wishes to drive long fashion in terms of behavioral alteration, emerging sanitation organization and refining management of waste practices. Technology can aid in modernizing sanitation management to enable "Swachh Bharat Mission" using social transformation or infrastructure edges.

Growing population and rising standard of living has steered to escalate in waste production. Municipality dealing with solid waste comprises residential, domestic and commercial wastes produced in urban areas in any form might be solid or semi-solid as well as bio-medical wastes. Benign and cost-effective administration of municipal solid waste is a noteworthy challenging task for contemporary culture.

In view of the environmental, social and health effect of management of waste cleanliness and sanitation, Indian government has initiated "Swachh Bharat Mission". The objective of the "Swachh Bharat Mission" is to advance management of solid waste practices leveraging recent technologies, abolish uncluttered defecation and labor-

intensive scavenging to bring about a change in private sector and behavior change. Some of the crucial technologies pertinent to attain goals of "Swachh Bharat Mission" embrace:

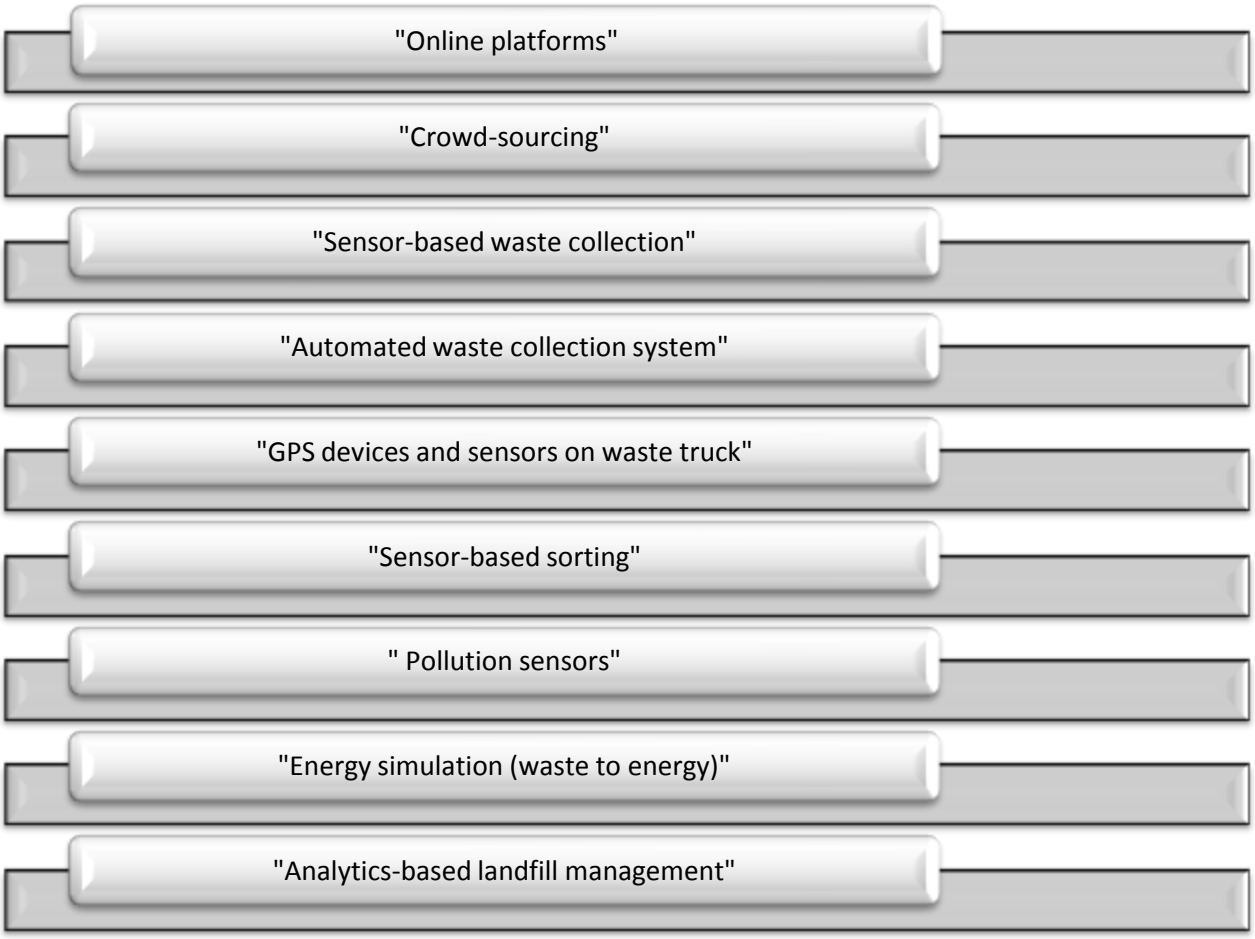

Figure: 1.3Technological apps for achieving Swachh Bharath

The Swachh Bharat Mission will encompass 4041 cities in India in the following 5 years. Consulting the "Swachh Bharat mission" intentions will entail a massive change socially and in the way of handling waste and sanitation. Technology will develop into the vital enabler in developing efficacy & capability of urban amenities to advance the value chain of the waste and sanitation. Technology helps in attaining Swachh and smart Bharath.

ET Bureau, (2016) this article identifies the immediate need for new rules regarding management of waste. This study also takes into account all the varied types of wastes (which includes solid, e, bio-medical, plastic ...). These rules have been prepared and will be soon functional. Regarding this, all the state governments will be instructed on adopting these techniques for environment safeguarding and engaging India in the direction of development. All these will be put into force post Paris.

Despite all the above measures that are been formulated after a thorough study of the existing and prevailing practices it is focusing on the management of waste generated. But this article Green Biz, (2015) focuses on waste prevention than management of waste. Managing 12 million tons of waste every day is a tedious job. It also states that waste prevention increases revenue and cuts the cost at bottom line. It accounts to 34 million tons every day in land filling and forms the main source of methane emission in US. Soon all the companies will be constrained to follow environmental friendly activities by preventing waste at source. All using big data analysis the techniques of

monitoring waste production, prevention, auditing can be made transparent. Management of waste is no more a viable solution. While diverting the focus from management to prevention problems of prevented has been raising. Before they give suitable solutions for preventing through modifications in packaging, disposal etc. land filling is in full swing. However once the techniques have been given it will have a great shift in profitability and sustenance.

1.5 Techniques for solving the problem of waste management:

With the growing problems in sanitation, pollution and hygiene in the country there are different solutions and techniques adopted by the government and different organizations at different levels. Anon., (2008)Though regionalization strategies have been confirmed as good strategies for "Municipal Solid Waste" (MSW) management in earlier studies, the optimum distribution of the waste stream is considerably affected by numerous factors that are influential, thus additional examination of the effects of these aspects on local MSW administration plans is required. It demonstrated the effects of "waste-to-electricity transformation coefficient" (WETC) of incinerators and the oscillation of unit tipping fees on the regional MSW allocation of the Taipei metropolitan area from practical and economic perspectives. Real-world data and linear programming were used to obtain the least-cost alternatives under different scenarios. Analytical results indicated some treatment facilities had geographic superiority and their priorities changed when actual WETCs of incinerators were considered. Treatment facilities located at weighted centers were identified. The allocation of MSW among incinerators and landfills is affected by fluctuation of unit tipping fees within a certain range. Treatment facilities sensitive to the changes in unit tipping fees were also identified. Regression equations were also established that can estimate the cost items of MSW management scenarios with different unit tipping fees. The results of this study are very useful for daily basis regulation of MSW administration.

The research paper of Hishashi, (2011) provides an analysis of different types of solid waste. It studied the failure of management techniques of waste and probes into the factors causing it. There are so many constraints leading to the violation of these rules like financial, technical, social, economic and institutional constraints Management of waste being the crucial task in both developed and developing countries. This study brings into light the need of scrutinizing solid waste disposal. It gives different approaches for developed and developing countries uncovering the gaps in techniques. Developing countries should focus on framing new legislations while developed countries should shift from land filling to recycling making potential use of waste. Developed country packed with industries and burgeoning industries in developing countries compels the introspection on management of waste. Based on the studies done some conclusions were like self-financing, awareness of the public, development of human resources, packaging alterations etc.

Nannyonga, (2007) studied the question whether this reduce, reuse and recycle is economically viable or not. It is also an environmental point of view and the potential use of the waste revealed the limitations of violating the regulations that were laid down by the government. This study frames a detail procedure from collecting waste to recycling techniques for different types of waste. The data has been collected from primary sources .the acquired data is been analyzed by quantitative approach. This is done through formulation of objective function and constraints and is solved through non-linear programming method. This gives a solution for reducing the transportation costs and maintains the funds.ET bureau, (2015) notifies the amount of waste generated in cities from Bangalore to Delhi. 18 meter pile waste is accumulated in Mumbai. India drowning in detritus will face threat of garbage.it states that 377 million people in urban area are producing 72 million tonnes of waste daily out of which 45 MT is left untreated. Due to the development hazardous waste is increasing. So along with Modi's Swachh Bharath every individual should take a step forward to decrease the threat of garbage. Due to urbanization urban areas are expected to house 78%of the population. Chirala is scouting for land due to inadequate land for land filling. And private sector is on edges to enter the garbage management.

ET Bureau, (2016) this study reveals that a new mobile app will be introduced for the convenience of the citizens to complain about any problem in waste management. This is done in collaboration with NGO for the effective enactment of Swachh Bharath soon. Many leaders approve this. This app helps in resolving the complaints enabling 4041 ULB's and strives to achieve Swachh Bharath by 2019. It also provides MMS facility through which pictures can be sent for immediate action and to give a clear idea of the problem to take apt action. The Hindu bureau, (2015) it discusses about the views of advocates replicating the management of waste system of Techno park's. The minister was overwhelmed by the waste treatment plant and recommended that every house should have a waste

treatment plant to treat the trash at source level. A set up of facility is laid in 50 cents to treat 3 tons of waste per day.

Afullo & Odghiambo, (2009)This article studied the gaps in bin maintenance through a stratified sampling of households in. a detailed study of this gave a bin gaps of about different percentages in varied aspects that is contributing to this gap. It declared that an apt arrangement should be made for the reduction in the gaps.Narayana, (March 2009) Juxtaposes the % of carbon-based wastes, dust, dirt in western nations and complementing that of the western nations, the Asian cities solid waste is often comprised of 70–80% carbon-based matter, dust and dirt. Composting is found to be the finest choice to deal with the dirt and generated dirt and dust. Composting supports lower the transportation of waste and is disposed of in landfills. Numerous emerging nations recognized large-scale composting plants that ultimately became futile for several reasons. The main fault that steered to the ineffective formation of the plants was the absence of application of scientific methods that are simple to select the solid substance to be composted.

1.6 Waste management a primary step to attain effective smart cities:

According to the Department of Economic and Social Affairs, United Nations, (2014)54 percent of the people live in urban areas and by 2050, 2.5 billion people are estimated to be added to the urban population. The rapidly budding cities, comprising of 500,000 to one million populations, are in Asia and Africa. As urban areas are the drivers in the overall development, most of the major activities are concentrated in these areas. But this growth without much planning has threatened the sustainability of these cities. Figure 2.2 shows the projected growth in the world's population in urban and rural areas. There has been a dramatic change in the composition of population in rural vs. urban areas since 1950 and the projected growth shows a completely different picture altogether.

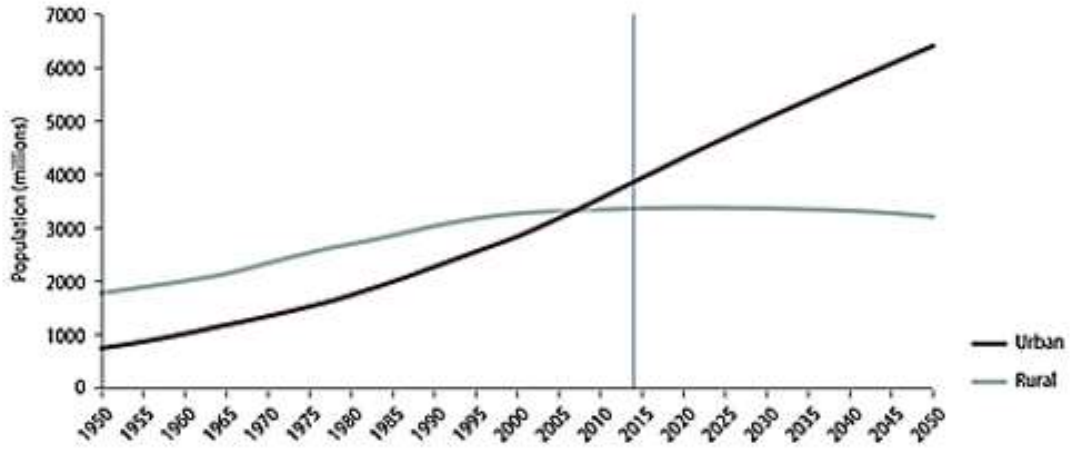

Figure: 1.4 Urban and rural Population of the world, 1950-2015
Source: Adopted from United Nations(2014)

ET bureau, (2016) In the light of achieving smart cities, government emphasizes on the management of waste. It laid down the importance of proper planning of urban areas, which are the major sources of waste in the country. In the name of development, cities have been rehabilitated to slums. After independence of 68 years 86%of sewage water is going into rivers including Ganga. Since the proprietors of the plant are blaming the constructors, hereafter the constructor will be responsible for the safety disposal of waste from that plant. Varied types of wastes can be regulated based on its specific norms from next month .Around 15000 tons of plastic waste is being stimulated every day out of which 6000 is being used and the remaining is left for centuries.

He says rather than trying to form new smart cities we should renovate the prevailing slums into smart cities.

In this remarkable growth, Africa and Asia are the quickest and fastest growing continents with the proportion of increase in urban areas by 1.5 and 1.1 percent yearly. It is projected that Asia will house almost half of the world's urban population by 2050 (52 per cent). Europe, who houses the second largest urban inhabitants, will have a drop in its urban population by 2015 as shown in figure 1.4.

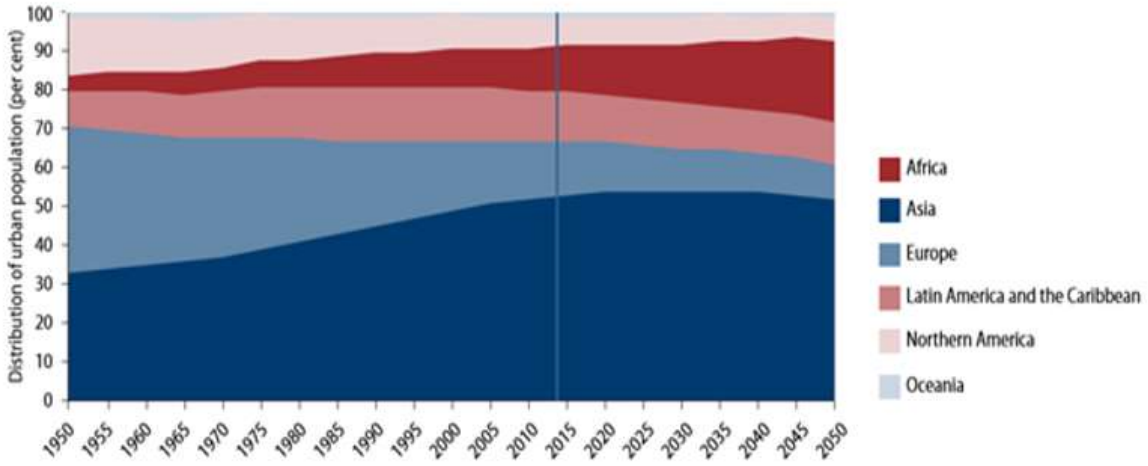

Figure: 1.5 Worlds Urban Population
Source: Adopted from United Nations(2014)

This growth in urban population contributes to a major pie in the amount of waste generated in India. Rising urban residents is aserious threat for the country in the dimension of management of waste.In Asia too, it is China and India who are leading the world's urban population number by accomodating 758 million and 410 million people respectively. To supplement this, the number of rural populace is projected to shrink by 52 million. This has further increased the need to look at the growing strain on cities with clearer vision of swacch bharath for leading to smart cities.

ET Bureau, (2016) Due to rapid urbanization in India, and the need to achieve smart cities soon gave birth to the sustainable and immediate need of management of waste in India. This idea of forming smart cities gave rise to four point strategy of waste to energy, solid management of waste, green urban transport and meeting housing needs for all. This too makes sure the formation of these smart cities will not have any adverse effects only the environment and ecology. It emphasizes on producing biogas through this solid waste, which meets the electricity needs of the inhabitants.

The Times of india, (2016) Miserable management of waste that is deliberated as the major difficult in the world especially in India will be resolved as a part of smart city development programme. "Agra Municipal Corporation" (AMC) plans a strategy to use high-tech schemes for proper management of waste. To upgrade the system of management of solid waste and to control the loopholes in the trash collection and disposal of waste these strategies will be useful. Besides these modern sensors for pollution will be modern pollution sensors will be fixed in various regions.

In Agra city as per the plan, 2.93 lakh automated wastebaskets labeled with "Radio frequency identification (RFID)" structures will be connected. An international standard scheme powered trash collection automobiles will follow these wastebaskets. These automobiles before delivering at dumpsite will pass through "sensor-based weighbridge and CCTV surveillance."

1.7 Conclusion:

All states are seriously working on the techniques of converting of waste to energy. Introduction to these techniques constitutes to form the most important aspect for effective management of waste. In the light of the significant role

management of waste plays in the current times, the current project formulated a software solution for fiancé accountability in the management of waste. The cumbersome managerial problems hitherto involved in various finance related issues associated with waste management, find an easy software solution in the current study.

