International Journal of Advances in Engineering and Management (IJAEM)
Volume 2, Issue 5, pp: 179-185 www.ijaem.net ISSN: 2395-5252

Electronic Waste, Issues By Technology, Policy or Improper Waste management-A Review

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Date of Submission: 05-08-2020 Date of Acceptance: 22-08-2020

ABSTRACT: The present paper deals with the sources of e-waste, issues generated from e-waste in India and worldwide. Proper recycling and disposal of e-waste is important to safeguard our earth from Environmental pollution. Many scientists carried out Extensive research on e-waste to know the impact of it on human beings as well as on environment. Improper management of e-waste creates future issues like, environment issue, resource generation, policy issue, financial issue, technology issue. After critical analysis of several reports based on e-waste it was found that challenges for managing municipal solid waste are, lack of political priority, limited Policy framework, increasing cost of waste management, increasing severity of adverse impacts, increasing quantities and changing composition. To minimize the e-waste a whole new range of industrial sector can be developed based on recycling waste materials. Many state government in India developing Recycling Industry. As long as electronic products continue to contain an assortment of toxic chemicals and are designed without recycling aspects, they would pose a threat to environment and public health at their end-of-life.

Key words: e-waste, policy issue, impacts, toxic, critical

I. INTRODUCTION:

` E-waste refers to thrown out electronic equipment like printers, Televisions, mobile phones, computers etc; which are harmful to our ecosystem if not disposed properly. Proper recycling and disposal of E-waste is important to safeguard our earth from[1] Environmental pollution. There has been extensive research carried out on E-waste disposal and scientists have taken samples from biggest e-waste dismantling areas in china to find out their impact on human health. Burning of E-waste releases poisonous gases which creates air pollution and also affects the epithelial cells of human lungs and cause cancer[1].

As per reports, it is estimated that around 20-50 million tons of E-waste gets generated every year which gets exported to different regions for disposal. A huge proportion of E-waste gets exported to China and African countries like Ghana for disposal and recycling. Because of improper disposal and poor recycling process[2], lot of pollutants including heavy metals like lead, cadmium and persistent organic pollutants gets released from E-waste which can affect the human lungs as they contaminate the air. When exposed to such harmful gases released during burning of E-waste, the human lungs can develop cancer and get affected by respiratory diseases. The tested pollutant samples by the researchers, showed increase in levels of ROS and IL-8 which lead to inflammation and oxidative stress in lungs. Some samples of E-waste where found to release phthalates which can impact sexual reproduction. Hazardous chemicals like chlorinated dioxins get released through E-waste which leads to cancer[2]. Also dumping of E-waste in landfills is done in many countries which result in soil pollution. E-waste recycling generates plenty of valuable resources such as iron, aluminum, copper and gold. It also contains certain heavy metals like lead, tin, bauxite, cadmium etc. Instead of dumping or burning E-waste, proper recycling of the used electronic products can save these natural resources and also safeguard our environment from pollution[3]. When E-waste gets burned, they release poisonous gases including CO2, Sulphurdioxide which lead to air pollution and also affect the ozone layer of our atmosphere. The ozone layer is responsible for preventing the harmful Ultraviolet rays of sun from reaching our earth. Due to depletion of ozone layer, there is global warming which can bring drastic changes to climatic patterns of our earth. Improper disposal of E-waste results in release of hazardous chemicals like lead, chromium, mercury, chemical flame retardants and beryllium which is dangerous to soil and water. The hardware and computer server usually contain chromium, mercury and cadmium etc. while LCD screens and Flat panel TVs have lead. For safeguarding the natural resources such as social and water from such toxic chemicals, E-waste should be recycled properly instead of dumping or burning in remote areas [4]. Due to ever-growing demand of electronic gadgets, the amount of E-waste which gets generated every year is increasing in a drastic manner. So, proper disposal and recycling of E -waste is very important to safeguard our environment from pollution and also to protect human life.

1.1. Hazardous substance in e-Waste:

Some of the common hazardous substances present in E-waste are as listed below

a) Arsenic – Present in LED lights
b) Cadmium – Present in CRT screens, Rechargeable Ni-Cd batteries and photocopiers
c) Lead – Present in batteries and CRT screens
d) Mercury – Present in Fluorescent lamps, LCD screens, alkaline batteries etc.
e) Lithium – Largely present in Rechargeable Li-On batteries
f) Chlorofluorocarbon (CFC) – Present in Condensers, Insulation foam and cooling units
g) PCB (polychlorinated biphenyls) – Present in Transformers and Condensers
h) Selenium – Photocopiers

All the chemicals listed above are dangerous to human health when inhaled through air or absorbed through drinking water. Chronic exposure to arsenic could cause skin diseases and impact nervous system. It can also lead to lead cancer which is fatal disease. Exposure to barium can cause muscle weakness, brain swelling and impact spleen and liver. It can also increase blood pressure and affect health of human heart when exposed for long time period. Cadmium is another hazardous chemical which can have dangerous impact on health of our kidneys. Chlorofluorocarbons are compounds composed of carbon, fluorine, chlorine, and sometimes hydrogen which affect the earth's ozone layer. All the chemicals listed above pose some form of threat to human health when exposed for certain time period. When E-waste gets burned, the people living in neighborhood will get exposed to the hazardous chemicals listed above which can lead to cancer, respiratory problems like asthma and other disorders. Also, dumping of E-waste will[3] lead to soil pollution and affect the fertility of soil causing soil erosion. So, great care must be taken to recycle E-waste effectively in order to save natural resources and reduce pollution[5].

1.2. The Indian Scenario

While the world is marveling at the technological revolution, countries like India are facing an imminent danger E-waste of developed countries, such as the US, disposes their wastes to India and other Asian countries. A recent investigation revealed that much of the electronics turned over for recycling in the United States ends up in Asia, where they are either disposed of or recycled with little or no regard for environmental or worker health and safety. Major reasons for exports are cheap labour and lack of environmental and occupational standards in Asia and in this way the toxic effluent of the developed nations 'would flood towards the world's poorest nations. The magnitude of these problems is yet to be documented. However, groups like Toxic Links India are already working on collating data that could be a step towards controlling this hazardous trade. It is imperative that developing countries and India in particular wake up to the
monopoly of the developed countries and set up appropriate management measures to prevent the hazards and mishaps due to mismanagement of e-wastes[6].

II. ISSUES IN MSW MANAGEMENT

2.1. Source Segregation, Collection:

In India there is virtually no organized and scientifically planned source segregation except for industrial waste where due to organized nature of sector, segregation is sometimes practiced and for healthcare waste due to regulatory requirements. Sorting is mostly done by unorganized sector (scavengers and rag pickers) and rarely done by waste generators. Hence, the efficiency of segregation is quite low as the unorganized sector tends to segregate only those waste materials which have relatively higher economic return in the recycling market. The unsafe and hazardous conditions under which the segregation and sorting takes places are well known. The waste collection efficiency even in high income cities (i.e. Delhi) is rather low. Often a substantial amount of waste is left to rot on the streets and/or is dumped into low lying areas, canals, rivers etc. Several factors are responsible for such low collection efficiency; lack of appropriate collection systems, lack of and/or inadequate collection [236] facilities such as waste disposal bins, collection vehicles etc., lack of funds, lack of and enforcement of appropriate regulations etc.[7,8].

2.2. Treatment & Disposal

MSW is usually disposed as it is without any treatment. Most of MSW is still disposed off in dumps causing severe environmental and health risks. The progress in moving towards sanitary landfills and/or disposing through well designed and well operated incinerators is rather slow.

2.3. Resource Generation

Lot of materials can be recovered from waste for recycling which can then serve as an input for manufacturing. Of particular significance are cellulosic materials, plastic, metals and glass. Despite the absence of organized segregation systems, quite substantial amounts of clean plastics, cellulosic material, metals and glass are already recycled in India due to their increasing amount which attracts economically. A large number of people ranging from rag pickers to primary dealers, secondary dealers and recycling industries earn their living out of waste recycling. In contrast, organic waste, which constitutes the largest proportion in the waste stream, is often disposed of rather than being segregated and converted into bio-gas, compost etc. Landfill gas is mostly unutilized. Only recently, some efforts have been started to recover energy from waste [8].

2.4. Policy Issues:

A vigorous policy framework to give a direction and thrust to environmentally sound waste management does not exist in India. Policy measures to promote waste minimization, recycle and recovery are rather lean. No national targets have been set up to deal with overall issue of waste management in line with country's economic development programme. The environmental policies are, discharge end control based instead of shifting to source end control based approach. The industrial policies continue to rely on manufacturing from virgin resources and a rational pricing mechanism and/or market based instruments to accelerate waste minimization and support greater use of recycled materials are not in place. Most of the current policies are in support of end-of-pipe approach creating huge burden on municipal authorities. There are no policies to promote segregation and reuse at source and conversion of waste into useful materials/energy[9].

2.5. Technology Issues

Launching targeted efforts for development/acquisition of technologies for material and energy recovery from waste is the need of the hour in India. To build confidence and test the application of such technologies in the context of developing countries pilot demonstration projects need to be established. This in turn will require extensive data collection on waste characterization and quantification to facilitate assessment of recycling/recovery potential and design/development of technologies. Almost no effort seems to be taking place in this direction. Most of the work is focused on augmenting waste collection and building disposal facilities [10].

2.6. Financial Issues

To support waste management one of the most pressing issues is the availability of funds. The local authorities are mostly not in a financial sound position and are barely able to maintain the basic jobs of waste collection and somehow dispose it. Municipal level waste management continues to be heavily subsidized by governments. Financing mechanisms to promote use of environmentally Sound Technologies, for technology development and demonstration are conspicuous by absence [11].

III. FUTURE CHALLENGES IN MSW MANAGEMENT

A successful long term planning depends on the characteristics of the solid waste and estimation of future quantities. Decisions related to treatment choices and disposal options for solid waste management will get affected by the composition of solid waste in the future. Researchers have been reported for innovative and forward-looking solutions to address the issue of forecasting the quantities of municipal solid waste [12]. Although both planning and design of municipal solid waste management systems require accurate prediction of solid waste generation. Yet achieving the anticipated prediction accuracy with regard to the generation trends facing many fast-growing regions is quite challenging. A long time forecast will be more meaningful if it gives the most optimistic, most pessimistic values and also the most likely values. Most traditional statistical forecasting models, such as the geometry average method, saturation curve method, least-squares regression method, and the curve extension method, are designed based on the configuration of semi-empirical mathematical models. The structure of these models is simply an expression of cause-effect or an illustration of trend extension in order to verify the inherent systematic features that are recognized as related to the observed database. Traditional forecasting methods for solid waste generation frequently count on the demographic and socioeconomic factors on a per-capita basis. The per-capita coefficients were taken as fixed over time or they may be projected to change with time. Grossman et al.[19] discussed such considerations by including the effects of population, income level, and the dwelling unit size in a linear regression model. The influence of per capita income, population density, persons per house, GDP and population on the composition of the solid waste using linear regression have been established by Khan and Burney[8]. For year 2025, using subjective judgment based on a single factor GDP of the nation, Gupta et al.[9] projected the quantity and characteristics of solid waste. However, the quantitative relationship between waste characteristics and GDP was not been established and a subjective judgment was used for prediction. Buenrostro et. al.[5] reported relationship between solid waste composition and socioeconomic factors of community using expert judgments based on secondary data. Dynamic properties in the process of solid waste generation cannot be fully characterized in those model formulations. Chang et al.[10] reported the econometric forecasting as one of the alternatives to static models, in which the future forecasts are derived from current forecasts of the independent variables themselves. It covers part of the dynamic features in forecasting analysis. When recycling impact is unparalleled, intervention analysis may account for the varying trends of solid waste generation under uncertainty[13]. The grey dynamic model was developed to resolve the data scarcity issue. It is particularly designed for handling situations in which only limited data are available for forecasting practice and system environments are not well-defined or fully understood. Grey fuzzy dynamic model suitable for the situation when only very limited samples are available for forecasting practice, was demonstrated to handle the dynamic prediction analysis of municipal solid waste generation with reasonable accuracy by Chen and Chang[24],. Dynamic MSW generation analysis has been done using time series data of solid waste generated quantities by Morita and et. al.25. They proposed some tools for time series analysis and forecasting to study MSW generation. A prediction technique based on non-linear dynamics was proposed, comparing its performance with a seasonal Auto Regressive and Moving Average (ARIMA) methodology, dealing with short and medium term forecasting. Lilai Xu .et al.[26] presented a system dynamics modeling for the prediction of solid waste generation in a fast-growing urban area based on a set of limited samples. To address the impact on sustainable development city wide, the practical implementation was assessed by a case study in the city of San Antonio, Texas (USA). The analysis presents various trends of solid waste generation associated with five different solid waste generation models using a system dynamics simulation tool – Stella. Srivastava et. al.[23]reported using Fuzzy regression based approach for forecasting that the percentage of waste paper and food waste is expected to decrease from 29.50 to 24.58 and 36.37% to 27.55%, respectively, between years 2007 and 2024 for the solid waste composition of Delhi, India. On the other hand the waste plastic content is expected to increase from 2.74% to 3.55%. The most significant change is expected with respect to the percentage of metals and glass, which has been estimated to increase to triple and double, respectively. It was suggested that while planning the capacities of the solid waste management facilities, maximum possible values should be taken into account, whereas the economic viability of recycle/recovery and compost facilities should be evaluated based on the minimum possible values also the forecasting results signify the importance of controlling the calorific value of the waste so that it should not fall below the rated calorific value of incinerator. The trend of various components (%) of the municipal solid waste in Delhi can be identified from the available and projected data between years 1971 and 2024. It can be seen that inert materials and compostable matter are decreasing from 56% to 38.61% and 35.42% to 24.28% respectively while paper, glass and plastic showing increasing trend from 6.29% to 26.66%, 0.57% to 16.53 % and 0.85% to 5.48 % respectively. Kumar et al.[1] attempted to estimate the quantity of municipal solid waste that can be generated as 39,670 MT per year in municipal cooperation of ELURU city A.P, INDIA by 2026 considering four input variables Population, MSW generated, percentage of urban population of the nation and GDP per capita of the nation in the artificial neural network model.

3.1. Increasing Quantities and Changing Composition

Due to growth in population, changing lifestyles and consumption patterns, not only the quantity of waste generated is further increasing but quality and composition of waste is also changing particularly more and more hazardous and toxic waste is being generated both because of industrialization as well as end-of-life products. A noticeable change in composition is observed that as the standards of living improve the proportion of paper and plastics increases – in many developing countries it has doubled in one decade [14].

3.2. Increasing Severity of Adverse Impacts

The negative impacts of wastes on the local environment (air, water, land, human health etc.) are becoming more acute often resulting in public outcries and demands for action. The impacts of inadequate waste management are not just limited to local level but are now crossing boundaries and due cases like methane emission are even affecting global environment. More and more water bodies (both surface waters as well as ground waters) are getting contaminated. The land under and around waste dumps are heavily polluted and will require tremendous efforts and resources for rejuvenation[15].

3.3. Increasing Cost of Waste Management,

Cost of waste management is increasing on several accounts. Firstly, because of the increase in quantity of waste being generated, secondly, the changing composition of waste with increasing content of non biodegradable and hazardous substances requires increasing complexity and sophistication in waste management techniques and technologies. Finally, with increasing environmental and health awareness the demands on safe and environmentally sound waste management require more careful and extensive waste management [16.]

3.4. Limited Policy Framework,

As already mentioned, national and local policies on waste management are not yet comprehensive to, cover all types of waste, and all aspects of waste management in India. Policy framework to support resource recovery from waste is still inadequate in India.

3.5. Lack of Political Priority ,

In India, waste management loses out to other political priorities of health, education, infrastructure development, job creation, poverty eradication etc. The realization that waste management could be supportive of these issues is often not there. While these challenges may appear difficult to overcome and may dampen the required initiatives, in today's context, waste management also offers some exciting opportunities[17].

IV. OPPORTUNITIES FROM WASTE MANAGEMENT

Waste minimization or waste reduction at source is increasingly being realized as a component for enhancing competitiveness. Many industrial firms make a special effort to minimize generation of waste so as not only to reduce their waste treatment and disposal costs but also improve their resource efficiency. However, small and medium sized industry experience difficulties in systematically integrating waste minimisation actions into their overall management practices– largely as consequence of their time, expertise and money constraints. Due to increasing energy and material costs, recovery of materials and energy from waste is becoming more and more economically viable. A whole new range of industrial sector can be developed based on recycling waste materials. The Government of Gujarat in India is already contemplating an idea of establishing a, Recycling Industry Park. The current waste management cost can be reduced by designing the waste management systems, scientifically with focus on 3R .The volume of, residual waste after recovery / recycle of materials can be drastically reduced thus cutting down treatment and disposal costs. In studies conducted by UNEP it has been demonstrated that by adopting the Integrated Solid Waste Management approach the residual waste requiring disposal can be easily brought down to just 30-40%. In case the residual waste is sent to landfill, this would also mean that the life of existing landfills will be appreciably increased. Earnings from recovered materials and resources can further ease the budget requirements for waste management [18]. Recovering energy from waste can become an excellent source of renewable energy. Conversion of organic waste into useful materials (e.g. compost) and/or energy can apart from affecting a significant reduction in waste quantity can provide cheap and renewable energy. Other waste components which are not easily amenable to recycling (such as dirty plastic and paper) can also be converted into fuel, of course with due care for combustion related emissions. The private sector is getting increasingly involved in waste management so it is not just a service to be provided by the government. In many cities the entire range of waste management services – collection, transportation, treatment and disposal are now provided by private sector. There is a huge potential for engaging private sector not only in recycling industry but also in establishing industry based on recycled material as input materials. This can have a snowballing effect in terms of directing private finances, job creation and industrial promotion. The beneficial environmental aspects in terms of reduced extraction of
non-renewable resources are obvious.

Empowerment of the poor and employment generation are the major demands in developing countries. Waste management with focus on segregation and recycling can serve the twin objective of creating employment opportunities for the poor and thus enabling them to improve their life styles. It can be treated as a business opportunity with a good potential for job creation [400].

V. CONCLUSION

In this paper, an attempt has been made to study the changing trends of quantity and characteristics of MSW to find its impact on the performance and capacity, planning of recovery/recycle, compost, incineration and landfill facilities. The changing pattern of waste composition emphasizes the importance of segregation for successful operation of waste management facilities. Municipal authorities should maintain the storage facilities in such a manner that they do not create unhygienic and unsanitary conditions. A new survey should be carried out on the generation and characterization of MSW in India. Since the MSW is heterogeneous in nature, a large number of samples have to be collected and analyzed to obtain statistically reliable results. As far as e-waste is concerned, it has emerged as one of the fastest growing waste streams worldwide today. The sheer amount of electronic equipments reaching end-of-life poses a huge challenge. As long as electronic products continue to contain an assortment of toxic chemicals and are designed without recycling aspects, they would pose a threat to environment and public health at their end-of-life.

REFERENCE:

a. UNEP "E-waste: the hidden side of IT equipment‟s manufacturing and use". Early Warnings on Emerging Environmental Threats No. 5, United Nations Environment Programme (2005).

[2]. Devin N.Perkins BS, Marie-Noel, Brune Drisse Tapiwa Nxele, Peter D.Sly, E-Waste: A Global Hazard, Annals of Global Health, Volume 80, Issue 4, July–August 2014, Pages 286-295.

[3]. M. Khurrum S. Bhutta, Adnan Omar, and Xiaozhe Yang, Electronic Waste: A Growing Concern in Today's Environment, Economics Research International/ Volume 2011 ,ArticleID 474230 | 8 pages | https://doi.org/10.1155/2011/474230

[4]. E-Waste In India Research Unit (Larrdis) Rajya Sabha Secretariat New Delhi June, 2011

[5]. Malviya R., Chaudhary R., Buddhi D. Study on solid waste assessment and management-Indore city. Indian Journal of Environmental Protection 22 (8), 841–846. (2002).

[6]. Third World Network. Toxic Terror: Dumping of Hazardous Wastes in the Third World,Third World Network, Malaysia (1991)

[7]. Jha A.K., Sharma C., Singh N., Ramesh R. Purvaja R. and Gupta. Greenhouse gasemissions from municipal solid waste management in Indian mega-cities: A case study of Chennai landfill sites. Chemosphere 71, 4119–4130(2008)

[8]. Chang N.B., Pan Y.C., Huang S.D. Time series forecasting of solid waste generation, J. Resour. Manag. Technol. 21, 1–10. (1993)

[9]. Buenrostro O., Bocco G. and Vence J. „Forecasting generation of urban solid waste indeveloping countries – a case study in Mexico, "Journal Air and Waste ManagementAssociation, Vol. 51, pp.86–93. (2001)

[10]. Srivastava A. K. and Nema A. K. Comparison of artificial neural network and ARIMAmodels for forecasting solid waste quantities‟, Proceedings of Indian International Conference on Artificial Intelligence (IICAI-05), pp.924–937. (2005)

[11]. Fung R. Y. K., Tang J. and Wang D. „Multiproduct aggregate production planning with fuzzy demands and fuzzy capacities‟, IEEE Transaction on System, Man and Cybernetics –Part A: Systems and Human, Vol. 33, No. 3, pp.302–312. (2003)

[12]. Bundela P.S., Gautam S.P., Pandey A.K., Awasthi M. K., Sarsaiya S. Municipal solidwaste management in Indian cities – A review International Journal of EnvironmentalSciences Volume 1,(4):591-606(2010)

[13]. Gupta S., Mohan K., Prasad R., Gupta S., Kansal A. Solid waste management in India:options and opportunities. Resources, Conservation and Recycling 24 (2), 115–137 (1998).

[14]. Chang N.B., Lin Y.T. An analysis of recycling impacts on solid waste generation bytime series intervention modeling, Resour. Conserv. Recy. 19, 165–186 (1997)

[15]. Chen H. W., Chang N.B. Prediction of solid waste generation via grey fuzzy dynamicmodeling, - Resour. Conserv. Recy. 29, 1–18 (2000)

[16]. Yoshizawa S, Tanaka M, Shekdar A. V. Global trends in waste generation. In: Gaballah

[17]. I,Mishar B, Solozabal R, Tanaka M, (editors) Recycling, waste treatment and clean technology, Spain: TMSMineral, Metals and Materials publishers; 2004. p. 1541–1552

[18]. Dyson B., Chang N."Forecasting municipal solid waste generation in a fast-growing urban region with system dynamics modeling", Waste Management 25 (2005) 669–679(2005)

[19]. Jha M.K., Sondhi O.A.K., Pansare M. "Solid waste management – a case study. Indian",Journal of Environmental Protection, 23, 10, pp 1153–1160(2003)

[20]. Lacoste E. and Chalmin P. From Waste to Resource – 2006 World Waste Survey, Paris:Veolia Environmental Services (2007).

[21]. Katsamaki A., Willems S. and Diamadopoulos E.,Time series analysis of municipalsolid waste generation rates", Journal of Environmental Engineering, Vol. 124, pp.178–183, (1998)

[22]. Municipal Waste Management Report published by UNEP Regional Resource Centre for Asia and the Pacific, ISBN 978-974-8257-73-0(2010)

[23]. Singhmar A., Agarwal A., Nema, A.K. and Mittal A.K. „Prediction of MSW in Delhi:application of SARIMA Model", Proceedings of 19th International Conferences on SolidWaste Technology and Management (2004)

[24]. 23. Rajendra Kumar Kaushal*, George K. Varghese , Mayuri Chabukdhara, Municipal Solid Waste Management in India-Current State and Future Challenges: A Review, International Journal of Engineering Science and Technology (IJEST) Vol. 4 No.04 April 2012

[25]. 24. H.W. Chen, Ni-Bin Chang , Prediction analysis of solid waste generation based on grey fuzzy dynamic modeling, Elsevier, Resources, Conservation and Recycling 29 (2000) 1–18

[26]. 25. Morita H, Kase T, Tamura Y, Iwamoto S. Interval prediction of annual maximum demand using grey dynamic model. Int J Elect Power Energ Syst 1996;18(7):409–13.

[27]. 26. Lilai Xu, Peiqing Gao c, Shenghui Cui, Chun Liu c,A hybrid procedure for MSW generation forecasting at multiple time scales in Xiamen City, China, Elsevier, Waste Management 33 (2013) 1324–1331