



Revisiting Solid Waste Management (SWM): a Case Study of Pakistan

Muhammad Abdul Rahman

Researcher at Sustainable Development Policy Institute Islamabad Pakistan

Keywords:

Solid waste management; carbon foot printing; incineration; household waste; industrial waste.

Correspondence:

Muhammad Abdul Rahman. Researcher at Sustainable Development Policy Institute Islamabad Pakistan.
E-mail: arahmandude@hotmail.com

Funding Information:

No funding information provided.

Received:

05 September 2013; Revised: 20 September 2013; Accepted: 25 September 2013

International Journal of Scientific Footprints 2013; 1(1): 33-42

Abstract

Pakistan is the second largest country in South Asia, inhabiting a population of approximately 180 million and ranking 6th largest one in the world. The question rises here whether the tools of Solid Waste Management (SWM) are sufficient for the large population and whether the management of solid waste in the country is up to the recognized standards and whether can it sustain a 6th largest population of the world? The impact of certain actions of a nation causes worldwide effects, no matter these are economic or environmental. The environmental effects are global, and every one sharing world's resources have to face the consequences of their actions which disturb the natural environment, SWM being a neglected issue, lacks proper attention, hence, it causes health and pollution problems. Effort has been made in this review paper to focus on resulting impacts of SWM in the country including, increase in Carbon Foot-Printing, dumping and its consequential issues such as some waste takes much time to decay, ground water pollution and its hazardous impact on the environment. Common methods used for dumping include the landfills, size reduction and screening. Industrial recycling has also been introduced, though at very thin level. The author, in this regard, has reviewed analytically the initiatives taken by the federal and provincial governments and their role. Privatization of SWM and to declare it as an industry can be an actionable option to mitigate the harmful impact of SWM due to mishandling of waste. Most importantly, illiteracy is another factor in mismanagement of SWM. This should be encountered on war footings as illiteracy is root cause of many other nationwide problems.

Introduction

1. Solid Wastes: An Overview

Solid Waste is anything counted as garbage, filth, purposeless or is a residue of a substance after it is being used. In the eyes of legislation, waste means

“any substance or object which has been, is being or is intended to be, discarded or disposed of, and includes liquid waste, solid waste, waste gases, suspended waste, industrial waste, agricultural waste, nuclear waste, municipal waste, hospital waste, used polyethylene waste and residues from the incineration of all types of waste”

(Pakistan Environmental Protection Act 1997).

The term management refers to the tools used for the proper execution of these wastes to protect the natural environment from their hazardous effects. In today's world where the population has increased so rapidly during the last 3 decades, solid waste management has taken a key importance in the daily life of every individual living in any part of the world.

1.1. Household Waste

Management of solid waste is one of the most disregarded areas in almost all developing countries (Murtaza and Rahman, 2000). In a country like Pakistan which is regarded as a developing country, types of solid waste may be categorized in three types of waste; household,

agricultural and industrial waste. According to an estimation, one to two third of the solid waste generated is not collected (Zurbrugg, 2003). Rapid urbanization of the population in the developing countries, especially like Pakistan, has greatly generated the phenomenon of solid waste generation. Solid waste management can be regarded as the subset of environmental planning, as the mismanagement of solid waste eventually damages the natural eco-system. Significant amount of budget is allocated in every country each year for the SWM, but the problem still exists. One of the reasons is the lack of proper management and technology in the collection of the waste. Likewise after collection, there is no proper way of disposal of the wastes. One of the common methods used for the disposal is dumping. Whereas dumping sites are the paradise for the breeding of the rodents and infectious agents. In Islamabad, a whole planned sector H-12, worth in billions of rupees is used as a dumping site. This is one, besides others, of the reasons that one can find rats and other species of this family in every house of the capital. Using other methods for disposal, instead of dumping, the precious land of the capital can be used for housing purpose and the revenue generated from this exercise can be used to make a revolution in SWM condition in the whole country.

1.2. Income Group and Production of Solid Waste

Income disparity due to rapid urbanization has also influenced the SWM. The urbanization in many developing countries led in the accumulation of the wealth increasing worldwide (Zurbrugg, 2003). As a result, the areas resided by the wealthier ones of the society, enjoy a proper management of household waste. In case of Islamabad the posh areas where there are financially and politically strong household, the municipal solid waste management is of good quality as compared to the suburbs of the capital. If this phenomenon is extended to the whole country, one can observe the same orientation. According to a survey conducted by Japan International Cooperation Agency (JICA), 35 % of the population of the country is urban and is producing 55,000 tons of solid waste per day. According to National Sanitation Policy, 2006, the sanitation facilities are available to only 42% of the population. 45% of the population has no facility of bathrooms, while 51% of the households have no connection with the drainage (National Sanitation Policy, 2006). All such conditions are creating sewer health issues as well.

In countries, like Pakistan where economies rely solely on agriculture, the solid waste not only comprises of household and municipal waste, but a big portion of it also

includes the agricultural waste. Annually, 140 billion metric tons of agricultural waste (biomass) are generated from agriculture worldwide. This amount is equal to 50 billion tons of oil approximately (Nakamura, 2009). The biomass is a chief source of methane gas emission and large scale of its burning cause's carbon dioxide emission in the atmosphere. Pakistan, chiefly, has an agrarian economy and its agriculture sector is a tool of employment to 45 percent population of the country which shares 20.9 percent in the GDP (Economic Survey of Pakistan, 2010-11). Agricultural sector is further divided into sub-sectors; crop sector, livestock sector, fisheries sector and forestry sector etc., each of these produces different type of waste depending on its nature.

1.3. Urbanization and Industrialization

Rapid urbanization in the country has created a number of problems as the cities are expanding without proper planning and strategy, causing many problems one of those but not the only, is increasing solid waste problems in the cities.

Sindh province of the country is the most urbanized province, while Khyber Pakhtunkhwa is the least. The decreasing dependency on agricultural sector has increased the trend of urbanization (Arif and Hamid, 2009). Migration of the people from towns and villages to cities and Metropolitan Corporation is one of the reasons of increasing urbanization trend in the country. The cultivable land is partitioned into pieces which eventually slows down the agricultural production and the inhabitants feel hard to meet both ends of their daily living being, and therefore in search of job they move to cities (Jan et al., 2008). Recent flooding in the country is another reason of migration to the cities. Most of the cities are not structured through a plan, and have a certain capability of holding the population. As a result of which, they are over populated and cause the problem of sanitation and SWM.

Urbanization has increased the industrial pace in the developing countries. Industries provide the habitants of urban areas with the employment. On the other hand the urban SWM is also affected greatly by the waste generated by these industries. One of the chief industrial solid wastes in the developing countries is the "Plastic Shopping Bag" made of PVC's. In Nepal, in 1999, a ban was imposed on the use of plastic shopping bags in Khumbu's region of the country (Khawaja, 2006) aiming to lessen the toxic impact of plastic bag both due to its burning in the open places and also as it takes much more time to decay if it is dumped. In Pakistan, main industrial waste includes the press mud from sugar industry, lime mud from paper and pulp industry, gypsum and calcium carbonate from the

fertilizer industry, coal ash from thermal power plants etc. (Khawaja, 2006). These wastes are drowned to an underground drainage facility, which is also at a verge of collapse due to lack or improper management system (National Sanitation Policy, 2006).

To make the capital of country as a model city, the Capital Development Authority (CDA) has recently initiated the Islamabad Green City Program, which is in the line of United Nations Green City Declaration 2005 which was adopted on World Environment Day on 5th June, 2005. It is well known fact that majority of the world population lives in the cities and is consuming 75% of the world resources (Green Cities Declaration, 2005). A city, in order to declare as a Green City, must have environmental consideration in waste reduction, urban design, energy, environmental health and water issues etc. (Islamabad, The Green City Program Ministry of Environment 2008).

2. Scope of Discourse

The aim of the study is to look at the past and present strategies and policies adopted and implemented by the central and provincial governments in managing the solid waste. Population growth is another issue to be considered regarding SWM, especially for a country like Pakistan inhabiting 6th largest population of the world (Population Reference Bureau 2011). Data sources have been used for analyzing the facts about the SWM conditions prevailing in the country. A number of studies have been conducted on the SWM including the surveys for the amount of waste generated by the household sector in some cities of the country. These surveys were conducted by some non-governmental organizations (NGO’s) and government agencies as well. The composition of the household waste has been analyzed and the ways of getting rid of these wastes have also been discussed by visiting the dumping site in the capital of the country--- Islamabad. A detailed interview of the waste collectors was conducted and the possible ways of dumping and recycling methods practiced in the capital have also been discussed.

In the capital, two sectors have been declared as industrial wherein a number of industries are there including steel mills, motor vehicle showrooms, flour mills, telecom sector industries etc. A visit was paid in this regard to study the composition of this industrial sector and the waste generated by these industries. The disposal of industrial wastes, which is the key point of this discourse, has also been analyzed.

Sialkot, an industrial and agricultural city, of Punjab province of Pakistan, has been taken as a sample city in this study. The city comprises of both urban and rural population distinctly. The former mainly constitutes

government employees and small and large scale private business holders. The rural population engages itself mainly in the cropping sector. There are some other industries in the city as well, and therefore Sialkot helps to study all three types of wastes generation viz. household, agricultural and industrial wastes. The management of the waste generated by these sectors has been dissected, whereas data analyzed was of secondary in nature.

3. Urbanization: A Modern Trend

Following table helps to analyze the urbanization pattern and increase in population in the country during the last three decades.

Table1: Urbanization Trend

Time Period	All Areas (in million)	% Change	Rural Areas	% Change	Urban Areas	% Change
1981	85.09		60.92		24.18	
2011	177.1	108.13 %	111.8	83.52 %	65.28	169.98 %

Source: Economic Survey of Pakistan, 2010-11

Table 1 shows an increase of 108.13% in the population during the last three decades which is roughly became double between the periods 1981 to 2011. It reveals that, the trend of residing in urban areas has increased to a large extent. Currently, 65.28 million people are residing in the urban areas while rural population constitutes 111.8 million. Despite the fact that more than half of the population is residing in rural areas, the urbanization trend has increased dramatically during this period. From 1981 to 2011, the urban population has increased about 169.92% while the rural population increment is only 83.52% which is very much less than the urban population--- tentatively a half of it. Rapid urbanization, eventually, demands the extension of sanitary conditions in the cities. Under the constitution of the country, the provision of civic facilities to the citizens is the responsibility of the provincial governments (Provincial Sanitation Strategy, Government of Balochistan).

This urbanization trend in the country has also caused increase in the industrial sector as these industries are the major source of employment for the people coming from towns and villages. At the same time the industrial waste is not properly disposed off. One can witness the dark black clouds of smoke over the industrial sectors of Islamabad. The brick kilns in the suburbs of the capital are also contributing to increase the waste in the capital of the country. SWM condition in other parts of the country is

worse as compared to the capital.

The agriculture sector, in spite of showing fewer yields per acre, is flourishing in overall production day by day. The production of major crops in the country has increased during the last three decades.

In nutshell, the SWM has become the core issue in the urban areas of the country.

4. Legislation, Government Policies, and Some Agencies in the Field

Administratively the country is divided into four provinces which are further divided into districts, subdivisions or Tehsils. In every Tehsil, there is Tehsil Municipal Administration (TMA), which primarily deals with all the developmental affairs. TMA is headed by the Nazim and performs a number of functions some of which include the prevention of encroachments, keeping the full records of villages and unions in archives of the Tehsil, planning short and long term development plans, to exercise control over land use for any purpose of agriculture, commerce, shopping centers, schools, recreational parks etc. In rural parts of the country, important objectives of these TMAs are to provide standard sanitation facilities to the local residents. SWM is the subject of the Tehsil Nazim who exercises his powers to make necessary measures for proper SWM.

In brief, there are four types of rules and regulations in operation for SWM in the country and are highlighted below:

1. Pakistan Environmental Protection Act 1997;
2. The Cantonment Act 1924;
3. Hazardous Substances Rules, 2007; and
4. Islamabad Capital Territory Bye Laws, 1968.

A National Sanitation Policy was also announced by the Federal Government in September 2006.

4.1. Pakistan Environmental Protection Act 1997

In this regard Pakistan Environmental Protection Act (PEPA) was promulgated in 1997 aiming to protect environment and was also for the protection of the species, biodiversity and to conserve the renewable resources. It helps in making desired framework for the federal and provincial Environmental Protection Agencies. Section 11 of the Pakistan Environmental Protection Act 1997 proscribes discharging any amount of effluent, waste, air pollution, noise pollution in a concentration more than the National Environmental Quality Standards (NEQS's). The government may impose a penalty on the person violating this law.

4.2. The Cantonment Act 1924

Section 132 of the above Act addresses the disposal of waste and rubbish in cantonment areas, run by their Boards. The Act provides two important provisions to the Boards to be implemented in their constituency; places or proper convenient sites to the people so that they can dump their waste, including the household waste, dead animal carcasses and sewage and all materials so dumped is the property of the Board. The Act is in operation in the Jhelum Cantonment Board area in Punjab province of Pakistan.

4.3. Hazardous Substances Rules 2007

These rules were issued for the protection of environment from the harmful substances and cover all the substances that are considered as hazardous for the environment and are categorized in to 3 distinct groups. These groups are labeled as red---extremely hazardous chemicals which are completely banned---orange viz. acutely hazardous chemicals are required to be strictly regulated and pink list of slightly hazardous chemicals. Individual seeking license for collecting and transporting the hazardous material must follows a number of instructions. Under the rules, the packaging and labeling of the hazardous substance must be in such a manner that it should be of appropriate size and there must not be leakage during the transportation of the hazardous substance. The substance in the container must not deteriorate in such a manner that it harms the environment. For labeling the type of substance in the container, the net volume of the container, name, address and license number of the licensee must be printed on the container. A picture of a skull and bones with the word DANGER in red color must be printed on the container.

4.4. Islamabad Capital Territory Bye Laws 1968

These are framed by the Capital Development Authority (CDA), which runs all the administrative and development affairs of the capital of the country. More precisely, these are called as 'Islamabad Capital Territory Municipal Bye Laws' and are framed to make the capital clean. These laid down main focus on the SWM in the capital particularly on the household sector of the city. The bye laws state that, the receptacle or the container for the sewerage must be clean, the water from the baths, or any offensive material from land or any building must be prevented from soaking in to the streets or public places or any other drainage that is not for the purpose of disposal. The rubbish must be disposed-off at the proper place failing which to comply with the rules is considered as a

defaulter and is punished.

4.5. National Sanitation Policy 2006

The Federal Government has issued a National Sanitation Policy in 2006 which focuses mainly on three "R"s that are recycling, reduction and reuse, issues the guidance to save disposal of liquid and solid wastes with emphasis on the advancement of health facilities. The policy provides the measures to plan and design sanitation plans for all urban areas which include the administration of the municipal and industrial water treatment frailties and landfill sites for appropriate disposal of solid waste. The government agencies are responsible to start relevant research and studies to plan some models for the safe removal of liquid, solid, industrial and agricultural waste.

5. Strategies Followed for Solid Waste Management in Pakistan

A number of practices are being exercised for disposing solid wastes. For household waste, open dumping is practiced frequently in each and every part of the country. Another way for disposing it at household level is the closed dumping or landfill. Simple burning is also exercised. At industrial and agricultural level, incineration is in the process, which is used frequently for disposing off the wastes and hospital waste is also disposed off by it.

5.1. Recycling

Recycling is the process of reusing the waste material after it is being processed through an appropriate channel. Currently, recycling is not done country wide on concrete basis. The sector is mainly involved in this business informally and earns profit. Modern machinery and mechanism for recycling in the country is not available, and each year the economy is losing a fair amount of revenue. A study conducted in Lahore city on recycling business reveals that it is a fruitful business. According to a survey during the study only 21.2 % of the solid waste collected from the city is being recycled which is roughly generating revenue amounting to Rs. 271 million. It is a remunerating business and scavengers (waste collectors) and the junk-shoppers gains a profit of 15 % and 14 % respectively. Recycling has not yet been given the status of an industry and if it is so given, it can generate revenue of more than 530 million with in the Lahore city (Batool, et al., 2008)

5.2. Disposal of Agricultural, Livestock and Poultry Waste

Being an agrarian economy, waste generated by

agricultural, livestock and poultry sector is reuse or efficiently consumed in each part of the country. Agriculture waste mainly includes the raw material generated after the harvesting of the crops. A big portion of the waste generated from this sector is used as a feed for livestock and poultry e.g. rice, chief export of Pakistan and contributes 4.4 in Value Added and 0.9 in GDP (Economic Survey of Pakistan 2010-11), after its harvesting, husking is done to separate the covering of the seed. The husk is used for multiple purposes like for making cardboard or as a feed for the livestock. Solid waste from the crops is also used in manufacturing paper. Livestock and poultry sector mainly generates dung (excreta) as solid waste which is disposed off in many ways. Mostly, it is used as manure in the crops as it is rich in organic matter. In villages, where natural gas is not available, people use to burn dung for cooking purpose as well. On small scale, biogas is also generated in some parts of the country from livestock waste. The history of biogas generation is as old that first biogas farmyard manure was established in Sindh during 1959. Later, in 1974 and 1986, many policies were made in this regard to flourish this business during 1974 and 1986 but failed to meet the targets due to lack of availability of finance and technology. Recently an initiative has been taken by Pakistan Dairy Development Company (PDDC) and Rural Support Programmes Network (RSPN) in rural areas of the country to establish biogas plants. Subsidies are given to the farmers for installation whereas manure from 5 to 6 cows/buffaloes is enough to run the small biogas plant. Biogas is a friendly gas with very small impacts on human health (Amjid, et al., 2011)

5.3. Disposal of Household, Industrial and Hospital Waste

Waste from household is generally disposed by open dumping i.e. thrown out of the houses on open land surface. This practiced is extensively exercised in the rural areas and suburbs of big cities, where there is no proper mechanism of waste collection. Open dumping is a serious threat for the human health and yet it is being practiced with the passage of time, these small dumping sites turn into a hill of solid waste, which serves a paradise for the rodent species and causes CH₄ emission and spread other diseases. In big cities where waste collection facility is available, open dumping is still practiced in some parts of the cities. The solid waste collected by scavengers in cities is usually disposed-off by closed dumping or landfill or by incineration. A big portion of industrial and hospital waste is also disposed-off by incineration process. Open burning for size reduction is also practiced (as responded by a scavenger in Islamabad) at the dumping sites, which releases harmful gases like carbon dioxide and carbon

monoxide, thus increases greenhouse effect and carbon foot printing. There is no proper and scientific way of calculating carbon foot printing in the country.

In a meeting with a worker of a small industry located at Islamabad, it appears that waste from the industry is disposed by dumping it in the pond near by locally known as "Nala Lai". This exercise creates a flood situation almost every year during the monsoon season in Rawalpindi. Though recycling units are available in the vicinity of the industry, yet these are not activated so the former practice is exercised for disposing

A sewerage water treatment plant has been established in one of the industrial sector of Islamabad, working under the Authority of CDA. A visit was paid to gather information about the SWM practice done. According to Mr. Zeeshan, a chemist at the treatment plant, the plant collects the sewerage water from Islamabad city and then processed it. The waste in the form of solid residue is collected in the large basins. This solid waste is then use as an organic fertilizer for the flora of the capital. Citizens can buy this organic fertilizer for their domestic use at very cheap rates. According to the respondent the selling price of fertilizer is Rs. 1000 per ton or precisely Rs. 1 per kilogram. The treatment plant has the capacity of processing 4 -7 million gallon of sewerage water per day. Another treatment plant is also working at Karachi besides other small plants in many cities of the country.

Hospital waste includes the used syringes, drip plastic bottles, plastic and glass bottles etc. A great care is required to dispose these items off as these are directly linked to the health of citizens. Mostly incineration is done for disposal but some studies show that are reused without any proper processing which is a big cause of Hepatitis C in the country (Jiwani and Gul, 2011).

6. Solid Waste Management in the Provinces

In the following lines, the author shall try to elaborate the state of SWM in the provinces of the country; Balochistan, Punjab, Sindh, and Khyber Paktunkhwa. Punjab being the largest province as far as population is concerned which is about 54% of the total population (Economic Survey of Pakistan 2010-11), is facing the problem of solid waste management problem more than the other provinces.

6.1. Balochistan

Geographically Balochistan is the largest province but inhabiting only 5% of the total population of the country (Economic Survey of Pakistan, 2011). Most of the population is rural and living in a very poor condition and the SWM situation is miserable. A number of strategies

have been planned and started with an incentive for the relevant government agencies to have a reward on good waste management practices. In this regard, an action plan was framed in 2008. The rewards are awarded on the following basis:

1. Rewards to Tehsils for each 'Excreta Safe' union;
2. Rewards to Tehsils for each 'Litter Free' union;
3. Rewards to Tehsils for each 'Foul Water Free' union; and
4. Rewards to the 'Cleanest' Union Council.

Currently the solid waste is dumped in open plots mostly by keeping in plastic bags and is not being able to use as manure. In the Sanitation Action Plan of 2008, TMAs are directed to set up separate trunks for recyclable and non-recyclable waste. TMA strictly disallows the use of plastic bags. Necessary step are also be taken with the help of public sector investment to start recycling of solid waste.

6.2. Sindh

Sindh is a province which has the largest population residing in urban areas, more than any other province of the country. But the SWM condition is drastically poor. Statistics show that a huge amount of money is spent on sewerage system management out of available funds while only 0.5 % is used for SWM (Policy Options Framework for Solid Waste Management in Sindh). According to a study, only 19% of the province has SWM facility (Sindh Devolved Social Services Program). A high level of disparity exists between rural and urban areas regarding the SWM condition which ranges from 47 % in urban areas to only 1 % in the rural areas. Karachi is the only city with high level of SWM condition as compare to other districts of the province.

In Karachi, where integrated forms of SWM practices are done, the condition is far better than as compare to other districts of Sindh. According to Sindh Local Government Ordinance 2001, SWM is distributed among a number of agencies. Section 54 (iv) of the Ordinance provides that "Sanitation and solid waste collection and sanitary disposal of solid, liquid, industrial and hospital wastes" be collected by the Taluka Municipal Administration . The Ordinance directs and empowers the Town Municipal Administration to collect solid waste and conveyance to transfer the waste to the designated stations but it does not apply the Town Municipal Administration for treatment and disposal of the solid waste and this responsibility is given to the City District Government Karachi. For rest of the districts of Sindh, TMA is responsible for collection and disposal of the waste. This is one of the reason of good SWM practices in Karachi from administration point

of view as compare to other districts of Sindh because in all other districts, TMAs have to cover all civic issues including water supply, sanitation and SWM and have little resources for all three sectors mentioned earlier. Another drawback of poor SWM practices in Sindh is the transportation scenario as the rural Sindh has the problem of deficiency of the solid waste vehicles for waste collection. Labor deficiency for collection and disposal is another issue.

According to local government department reports, a sum of 6,113 tons of garbage is generated per day (Policy Option Framework for Solid Waste Management in Sindh, Program Support Unit Devolved Social Services Program (SDSSP)). In the cantonment areas of Karachi, there are private lifters for the collection of the purpose. A sum of 2.7 tons of hospital waste is also generated by 200 hospitals in Karachi where a recycling industry at a small level is functioning, providing 55,000 families with employment.

6.3. Khyber Pakhtunkhwa

Khyber Pakhtunkhwa, formerly known as North West Frontier Province (NWFP), has a population of 17,744,000 according to census of 1998 (Economic Survey of Pakistan, 2010-2011). Province is far behind from other provinces of Pakistan in development perspective. SWM practices including the sanitary measures, household, industrial and agricultural waste are not properly handled and disposed off. A large population in the province is illiterate and hence is a big rather sole cause of poor SWM practices. Rural as well as urban residents are not fulfilling the clean environment practices. The province is severely affected by terrorism for the past 30 years which may also be regarded for the poor SWM practices.

Analysis of one of the well-known districts of the province---Abbottabad---may reveal the current condition in other districts of the province. A report by the International Union for Conservation of Nature (IUCN) for Abbottabad depicts a worse picture of SWM status in the district. It shows that almost 87 % of the budget of Abbottabad Tehsil and Havelian for SWM is used to pay the salaries to the staff, showing a deficit budget for conducting fruitful SWM activities in the Tehsil. Further the report highlights the generation of solid waste in the district which is about 42 tones per day. The negligence in administrating SWM may be seen from the fact that the solid waste collecting vehicles are larger than the streets of the district, which causes the poor collection of SWM and the people throw the waste in the open plots and streets, and in many parts of the district the people are

handicapped as regard solid waste collection facility.

Abbottabad is one of the important cities in the province with the existence of security installations. The current condition of SWM in the province is alarming as a number of diseases prevail due to bad SWM condition. From the current picture one of the well-known Tehsil of the province, reveals the overall condition for SWM in the province. In some districts of the province the SWM is completely shows its nonexistence. A great care must be made for the uplifting of the SWM condition in the province.

6.4. Punjab

Punjab is the largest province in the country in terms of its population, inhabiting a population of more than 70 million (precisely 73,621,000) according to the census of 1998 (Economic Survey of Pakistan 2010-11). Currently it is estimated to be more than 100 million and therefore the province with such a great population requires efficient form of SWM practices. The province is considered as the agricultural hub of the country and at the same time a number of industries with a huge number of textile industries exist in the province whose effluent contain significant amount of dyes which must be treated prior to release in waste water stream. The province requires a significant share of budget and attention to SWM.

A new innovative practice frequently used for SWM in Punjab is the application of Municipal Solid Waste (MSW) to the open fields that are rendered for cultivation purpose. This MSW is rich with organic matter, desired for optimal crop production. The practice, an innovative one, not only saves the application of pesticide and other harmful impacts during application of these pesticides but also saves the land and land water from the hazardous impacts from landfills. A study conducted in Punjab to analyze the impacts of MSW on the crop fields reveals an increase in the available phosphorus for the crops (Qazi, M. A. et al., 2009).

7. A Case study of a Sample City: Sialkot

Sialkot is a well-known city in the province with distinct urban and rural population and is known both as industrial as well as an agricultural one. Bats used in Cricket and Footballs are made in the industries located here and are used in the mega events of both sports i.e. the World Cup. The population of the city is about 0.80 million and is estimated to be doubled by 2030. The importance of this city as the economic hub of the country cannot be denied. It is the third largest economic hub of the country and second largest in earning foreign exchange for the country. A project was conducted in 2010 by GHK, a leading

independent multi-disciplinary consultancy agency, and Government of Punjab in Sialkot for estimating the waste generation per day in the city. The city was divided into three groups as regard their income levels to compare the amount of waste generation in the city. SWM condition is very poor in the city. According to GHK report of 2010, the daily waste generation is about 350 tons which makes a cumulative of 125,000 tons per year. By the year 2030 the estimated doubled population will generate more than double solid waste than today's rate which will be approximately 300,000 tons per year.

SWM facilities are available to only 25 percent of the population, leaving 75 percent with lack of appropriate facilities. The survey reveals that composition of the solid waste among the three different income groups of the city is more or less same. The largest portion of waste consists of food and organic elements and it comprises 40 percent of the total waste. The second largest waste components are the plastic and paper followed by glass, leather, wood and metals.

Each year TMA allocate a handy budget for the SWM practices in the city but, most of it is consumed for staff salaries. For example according to GHK report 2010, in the year 2008 Rs. 137.20 million was allocated by TMA for SWM, whereas 87 percent were consumed on staff salaries, leaving only 13 percent for SWM practices.

Recycling and dumping practices exercised for waste removal are not up to date and needs proper attention of the authorities concerned. Recycling---mostly at private level is also done on small scale in the city which is less than 30 percent---. Most of the waste like the empty oil canes, raw metals and obsolete and old electrical appliances are sold and recyclers collect these items from the houses with the help of their para-recycling workers who supply these items to them. Another way of disposing off solid waste is simple burning as most of the waste is burnt out or buried in land for disposal which causes serious harm to the environment and to human health as well. Another way of disposal practice is throwing of waste along the river banks which pollutes the running water and causes damage to livestock health as river water is mostly consumed by the cows and buffaloes of the household. This water is also used for irrigation purpose in the respective catchment areas for agriculture produce, especially for rice cultivation, which is the chief produce of the area. The harmful impacts of polluted water on crop growth affect the human health after it is being consumed. In the light of forgoing discussion and considering the city as an economic centre of the country, it can be concluded that the city demands an efficient way of disposing off solid waste generated, so that it can minimize the economic cost of this solid waste in terms of health. It is

the utmost responsibility of the industries installed in the city to make proper way for disposal of the waste generated as by-product. From government perspective, it will be more helpful if private sector is allowed to invest in SWM sector. This will generate the job opportunities at local level, and will generate revenue for government as well.

8. SWM and Carbon Foot Printing

Emission from the solid wastes are contributing in increasing carbon content in the atmosphere leaving hazardous impacts on the environment for a long time and gives rise to a phenomenon known as Carbon Foot Printing (CFP). A lot of work has been started globally in the recent past to calculate the CFP generated from the solid waste. A country like Pakistan, where there is no modern mechanism for collecting the solid waste and related SWM practices, the harmful impacts of increasing carbon may affect the human as well as plant and animal health. Increased carbon contents in the atmosphere cause an increase in the temperature and one can witness long summer season in the country during the past ten years. A number of models have been made by the international agencies to calculate CFP and try to mitigate the risky effects of carbon on human health. One of the models is designed by Environment Protection Agency (EPA) called as Waste Reduction Model (WARM) and another model by HDR engineering called as Waste Carbon Assessment Planning Tool (Waste CAPT) is also there. The former provides help to the waste managers to track Green House Gas emission (GHG) while the later helps the managers to evaluate the planning impacts of various programs over the time and to develop goals to decrease the GHG emissions (Traeger, et al., 2008).

9. Epilogue

Pakistan acquires a lot of potential in many field of daily life. There are snow covered mountains at one side and hot deserts like Thal and Thar in Sindh and Punjab provinces at the other. The dire need is to use the resources available in the country optimally for every citizen regardless of any discrimination of rich and poor.

SWM is gaining attention internationally with the increase of population of the world, which recently has crossed the number of 7 billion by birth of a child in India. The increment from six billion to seven billion just took 12 years. So, one can understand the pressure on the limited resources of our world (Population Reference Bureau). Though, Pakistan has succeeded in controlling its national birth rate during the past 12 years which was 2.69 percent per annum in 1981-98 which is now 2.05 percent in 2010

(Economic Survey of Pakistan 2010-11). But having a population around 180 million still requires efficient measures to conduct SWM practices in the country.

A national SWM institute must be established by the government to run SWM practices country-wide. The institute then may have its regional branches in several parts for each province and then further divided to district level thus having smooth flow of instructions from the headquarters. Funds should be increased for SWM practices as most of the available funds are spent on staff salaries.

Another way for efficient implementation of SWM is to privatize SWM and to declare it as industry. Recycling is one of the profitable businesses that can be run from SWM industry generating money for the tax-payers.

The nation is facing the dilemma of illiteracy which is another big issue in having good SWM practices. A great care is required to make the citizens aware of the importance of SWM for them in terms of their health and for the nation. Inclusion of literature on SWM in school syllabus can be helpful in mitigating the problems that arises from inefficient SWM practices.

References

- [1] Amjid, S. S., Bilal, M. Q., Nazir, M. S., Hussain, A. (2011). Biogas, Renewable Energy Resource for Pakistan. *Renewable and Sustainable Energy Reviews*, 15:2833-2837.
- [2] Arif, G. M., Hamid, S. (2009). Urbanization, City Growth and Quality of Life in Pakistan. *European Journal of Social Sciences*, 10:196-215.
- [3] Batool, S. A., Chaudhry, N., Majeed, K. (2008). Economic Potential of Recycling Business in Lahore. *Pakistan. Waste Management*, 28:294-298.
- [4] Batool, S. A. & Chaudhry, M. N. (2009). Municipal Solid Waste Management in Lahore City District. *Pakistan. Waste Management*, 29:1971-1981.
- [5] Government of Balochistan. (2008). Local Government and Rural Development Department Balochistan. *Provincial Sanitation Strategy and Action Plan 2008*.
- [6] Government of Pakistan. (2010). Ministry of Finance, Economic Wing. *Economic Survey of Pakistan, 2010-11, Islamabad*.
- [7] Government of Punjab. (2010). *Sialkot Solid Waste Management Strategy and Action Plan. Final Draft*.
- [8] Government of Punjab. (2010). *Sialkot Waste Assessment and Characterization Survey. Final Draft*.
- [9] Government of the Islamic Republic of Pakistan. (2006). *National Sanitation Policy 2006. Ministry of Environment*.
- [10] Green Cities Declaration. (2005). *Urban Environmental Accords. United Nations Environment Programme*.
- [11] International Union for Conservation of Nature (IUCN). (2006). *Solid Waste Management. Report. Environmental Fiscal Reform in Abbotabad 2006*.
- [12] Islamabad Capital Territory Municipal Bye Laws 1968.
- [13] Jan, B. & Iqbal, M. I. (2008). Urbanization Trend and Urban Population Projections of Pakistan Using Weighted Approach. *Sarhad J. Agric.* 24:173-180.
- [14] Jiwani, N. & Gul, R. (2011). A Silent Storm: Hepatitis C in Pakistan. *J of Pak Med St.*, 1:1-3.
- [15] Khawaja, M. A. (2006). *Industrial Waste Management: Reduction at Source, Reuse and Recycling for Sustainable Industrial Production. 3R Waste Management South Asia Expert Workshop Kathmandu*.
- [16] Nakamura, T. (2009). *Waste Agricultural Biomass Conversion. The 6th Biomass Asia Workshop, Hiroshima*.
- [17] Policy and Regulations on Solid Waste Management-Pakistan. (2010). *Report. Converting Waste Agricultural Biomass into Energy Source-Legal Framework and Financing Mechanism for Waste Agricultural Biomass (WAB)/Solid Waste in District Sanghar, Pakistan*.
- [18] Population Reference Bureau. (2007). *World Population Data Sheet 2007*.
- [19] Population Reference Bureau. (2011). *World Population Data Sheet 2011*.
- [20] Population Reference Bureau. (2011). Available at <http://www.prb.org/> cited on 10 November 2011.
- [21] Qazi, M. A., Akram, M., Ahmad, N., Artiola, J. F. & Tuller, M. (2009). Economic and Environmental Implications of Solid Waste Compost Applications to Agricultural Fields in Punjab. *Pakistan. Waste Management*, 29:2437-2445.
- [22] Shah, Z. A. (N.D). *Policy Options Framework for Solid Waste Management in Sindh. Program Support Unit Devolved Social Services Program*

(SDSSP). Financial Department. Government of Sindh, Pakistan.

- [23] Tehsil Municipal Administration: Powers and Functions of the Tehsil Municipal Administration. Available at http://www.nrb.gov.pk/local_government/tehsil_municipal_admin_01.htm.
- [24] The Cantonments Act. (1924). Available at http://bdlaws.minlaw.gov.bd/pdf_part.php?id=133.
- [25] The Gazette of Pakistan, Pakistan Environmental Protection Act 1997.
- [26] Traeger, D., Bedwell, E. & Dunbar, K. (2008). Solid Waste Carbon Planning Toll. 16th Annual North American Waste-to-Energy Conference, Philadelphia, Pennsylvania, USA 2008.
- [27] Zurbrugg, C. (2003). Solid Waste Management in Developing Countries. Eigenössische Anstalt für Wasserversorgung, Abwasserreinigung und Gewässerschutz (Swiss Federal Institute for Environmental Science and Technology / ETH) (EAWAG) and SANDEC. Adapted from the SWM Introductory Text. Available at www.sanicon.net.