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Initiatives in Solid Waste Management: A Case Study of the City of Bengaluru

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INITIATIVES IN SOLID WASTE MANAGEMENT: A CASE STUDY OF THE CITY OF BENGALURU

Natasha Kalra* and S Manasi**

Abstract

Globally, unplanned urbanisation has been posing serious administrative, economical, ecological and social challenges. Factors like increased labour migration to urban areas, high population growth, increase in consumption, higher disposable income, consumerism and change in lifestyle preferences are further pressurising the vulnerable civic services system, especially in the developing world.

One of the after-effects of urbanisation has been the high rate of waste generation, which is one of the major concerns for citizens, administrators, and policy makers, as well as, among experts from different fields. Apart from the traditional approaches like composting and landfill dumping, waste management is now witnessing several innovative initiatives and multiple stakeholder participation across various phases of waste management process starting from awareness to segregation, collection, transportation, treatment and disposal. Green movements like plog runs, compost santhe, zero-waste events & weddings, composting, recycling and events promoting eco-friendly products, green entrepreneurs are gaining momentum in the city. Multiple innovative techniques for information dissemination about effective waste management are been adopted both by local administration and citizens. For instance, black spot cleaning, anti-plastic & segregation awareness campaigns have been widely publicised through radio, television, banners and posters at public places and also through social media platforms like Watsapp groups, Facebook and Twitter handles. Some of the above mentioned initiatives have turned into best practices, which have been replicated successfully.

This paper is a modest attempt to understand and map the initiatives and few best practices in the process of solid waste management across the city of Bengaluru.. These initiatives have been classified and discussed in detail as per the process of waste management. Secondary data sources and some primary field observations have been referred to compile these initiatives. Subsequently, cases on three best practices have been discussed in detail. It has been observed that many initiatives have been undertaken under the phase of awareness creation on waste management and the phase of treatment of waste. Also the engagement of multiple stakeholders, particularly community participation, is relatively higher in these two phases compared to the remaining phases.

Key Words: Urbanisation, Stakeholders, Initiatives, local administration, and Solid Waste Management.

Introduction

According to Kaza *et al* (2018), global waste is expected to grow to 3.40 billion tonnes by 2050, which will be more than double the population growth over the same period. Globally, open dumping accounts for 33% of waste and some 37% of waste goes to some form of landfills with only 8% of global waste goes to sanitary landfills. Higher and upper-middle income countries are reported to have scientifically controlled landfills and efficient waste management facilities while in low-income countries 93% of waste is dumped in the open. Presently, world generates 0.74 kilogram of waste per capita per day. In terms of waste composition, food waste or green waste constitutes 44% while dry recyclables constitute 38%.

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According to the latest estimates by Central Pollution Control Board (CPCB) 1,43,449 tonnes per day of municipal solid waste (MSW) was generated in India during 2014-15. Out of the total MSW generated, only 80% of waste was collected, while 22% was processed or treated (MoUD 2016). A study, done by CPCB with NEERI (National Environmental Engineering Institute, Nagpur) in 59 cities, reported compostable waste constituting more than 50% of the total MSW. According to the 2015-16 report of standing committee on energy (Ministry of New and Renewable Energy) the total generation of MSW is projected to reach 165 million tonnes by 2031 due to increased urbanisation, industrialisation and changing life patterns. The report also highlighted the grams per capita for large cities, medium cities and small cities as 400-600 grams, 300-400 grams and 200-300 grams respectively. Also, there is a need for estimating the waste generated at village or Panchayat level which remains unaccounted till date.

Economic reforms of 1990s in India opened up the national and state economies leading to creation of a lot of employment opportunities, improvement in disposable income, and changes in the lifestyle of the people. An important trend with these reforms was of urbanisation and migration of workforce towards cities for employment, better living standards and also for better education. As the population and migration increased so did the consumption of goods and services, directly leading to increase in quantum of waste produced (Sridhar 2015; Beukering *et al,* 1999, Chanakya *et al,* 2010; Joshi *et al,* 2013).

A similar trend has been observed in case of Bengaluru, which is struggling with population increase, infrastructure bottlenecks, migration of working population towards the city. With the population of 10,207,063 (BDA Master Plan 2031) the city of Bengaluru generates 5,758 tonnes of MSW daily, which includes 64% of wet waste, 28% of dry waste, 6% inert waste and 3% of domestic hazardous waste. The waste generation in BBMP area amounts to 564 grams per capita per day (BBMP SWM manual 2017). As per BBMP (2017) the indicative composition of waste includes 30% of vegetable waste followed by 23% of organic. Plastic amounts to 12% while electronic and bio-medical waste accounts for 2% as indicated in Table 1 below:

Table 1: Indicated Composition of Waste in Bengaluru

S.No.	Category	Percentage
1	Vegetable	30
2	Paper	9
3	Plastic	12
4	Cardboard	4
5	Textiles	4
6	Grass/leaves/wood	6
7	Leather	0
8	Electronic item	2
9	Metal	1
10	Organic	23
11	Glass	3
12	Debris	5
13	Biomedical	2

Source: BBMP 2017

Bengaluru is the most urbanised district of all the districts in Karnataka with 90.94 per cent of its population residing in urban areas. The state of Karnataka has witnessed an increase in urban population by 31.27% in the last decade (2001-2011) compared to 28.85% in the previous decade. It is one of the most densely populated districts out of the 30 districts of Karnataka with a density of 4,378 per sq. km (Department of Public Instruction, Karnataka 2016). This puts immense pressure on the delivery of civic services. However, in recent times the city has witnessed cluster of moments which involve active participation of stakeholders, increase in awareness level of citizens, formation of multiple citizens groups, usage of social media platforms viz. Watsapp groups, Facebook and Twitter etc. to address grievances and introduce accountability with respect to various civic services. A variety of initiatives, ranging from awareness campaigns, rally to segregation, composting, up-cycling/recycling, compost santhe, drive against plastic, cutlery banks are catching up in the city to promote sustainable waste management. The city has witnessed active participation from different stakeholders like Non-Governmental Organisations (NGOs), Self-Help Groups (SHGs), Green Entrepreneurs, Itinerant buyers, citizens and the municipal corporation. Several citizens network have come into existence in the city which are actively engaged in various civic issues ranging from solid waste management to wildlife conservation, zoning and land use regulations, traffic and safety concerns, roads and infrastructure development etc. These citizens' networks have initiated the urban environment stewardship and are strong advocates of transparency and democratic conduct. Keeping in mind the accountability these networks bring into the administration, the role of the citizens in governance is a potential area to be explored. (Enqvist *et al,* 2014). These social relationships have helped people to act efficiently (Coleman 1988). One interesting observation is that these groups are using technology, especially social media, to increase their reach and are also ever expanding. The significance of the cooperation of citizens, or in other words, the service users, was in fact realised by the municipalities in 1980s and 1990s. On similar lines, a report by UN Habitat (2010) stressed on the role of stakeholders and mentioned them as one of the three dimensions of Integrated Waste Management for an efficient solid waste management system (UN Habitat 2010).

A study by Enqvist *et al* (2014), makes an attempt to describe a citizen network engaged in environmental issues in Bangalore, India, where rapid urbanisation puts pressure on conventional management structures as well as the ecosystems providing benefits for the city's inhabitants. The study uses a mixed method approach of qualitative interviews and social network analysis. The main findings of the paper illustrate that the citizen network functions as a platform that enables interaction between diverse interest groups, and as a watchdog that monitors parks, lakes and trees to prevent further loss of fragmented urban ecosystems. Authors also emphasize that this is important for monitoring Bangalore's fragmented ecosystems and for raising public awareness and support. Finally, the study highlights an urgent need to develop a comprehensive framework for urban environmental stewardship, to better describe potential roles of citizens in governance across diverse social, political and ecological conditions, and during different periods of urban change.

Henry, *et al* (2005), makes an attempt to understand the overview of the state of municipal solid waste management (MSWM) by local authorities in Kenya. They also discussed on poor servicing of MSW collection vehicles, poor state of infrastructure and the lack of adequate funding militate against

optimisation of MSW disposal service. In the end, of the paper, authors described involvement of stakeholders is important to achieve any meaningful and sustainable MSWM.

As study by Sharholy *et al* (2007), attempts to provide a comprehensive review of the characteristics, generation, collection and transportation, disposal and treatment technologies of MSW practiced in India. The study, pertaining to MSWM for Indian cities, has been carried out to evaluate the current status and identify the major problems. Authors also discussed various adopted treatment technologies for MSW that are critically reviewed, along with their advantages and limitations. The study concludes with a few fruitful suggestions like involvement of people and the private sector through NGOs that could improve the efficiency of MSWM and also public awareness should be created among the masses to inculcate the health hazards of wastes. Finally, the study points to the lack of resources, such as financing, infrastructure, suitable planning and data, and leadership, that are the main barriers in MSWM.

Zurbrügg Christian's (2002) paper makes an attempt to study the awareness and attitudes, some examples of continuous education and awareness campaigns like the regular "Green and Clean" campaigns to promote environmental awareness by the Metro Manila Women Balikatan Movement and the Green Forum in Manila (UNEP-IETC, 1996). He also refers to the example of the Environmental Pioneer Brigade Programme in Sri Lanka where children are made aware of environmental problems and shown how to manage the problems, or how to be preventative so that the problems do not occur. The study also makes reference to resource recovery and recycling activities like in the Philippines, where a growing number of local governments are implementing integrated waste management that includes waste reduction, recycling, composting and re-use. In Bangladesh, the local government authorities, as well as the Ministry of Agriculture, are supporting and promoting composting and the use of compost in agriculture. Similarly, in India the new solid waste legislation (Ministry of Environment and Forests, 2000) obliges municipalities to introduce household segregation of organic and non-organic waste (called "wet" and "dry" waste respectively) and to treat the organic fraction by composting or other appropriate means. The study concludes that in Asian low- and middle-income countries, municipal managers still face many common solid waste management problems. Although in some cities, successful innovative ideas and approaches have been implemented at different levels of the solid waste management system.

C. Visvanathan and J. Tränkler (2003) make an attempt to understand the present scenario of municipal solid waste management (MSWM) in four study countries of Asia – namely China, India, Sri Lanka and Thailand. The study compares technical, economic, legal and health issues. The authors also lay emphasis on the generation and composition of MSW, management needs and collection systems practiced, transportation and disposal systems used. The paper further discussed and reflected on the public awareness and participation of the community in MSWM as well as the involvement of the NGOs and the private sector. The study suggested that the uniqueness is attributed to the waste composition, involvement of the informal sector, voluntary groups, private organisations, NGOs, and community-based organisations (CBOs), and rapid privatisation of collection, transportation and processing systems. Finally, they conclude the paper by saying that the present scenario of MSWM, which is undergoing rapid changes towards the incorporation of the ISWM, could pave the way for sustainable urban

environment in Asia with effective inputs in economic, environmental and social aspects with adequate institutional arrangements.

Initiatives in waste management can also be classified into various categories ranging from legal framework, which includes several Constitutional, environmental and pollution Acts, to policy initiatives like National Sanitation Policy, 2008 to Ecomark Scheme, 1991. Another category of classification of initiatives can be key government programmes like JNNURM, Total Sanitation Campaign, etc. (Agarwal *et al,* 2015). However, public awareness and participation is seen as a major tool in the success of waste management (Hasan 2004) as they will bring accountability to the waste management system (Ahmed & Ali 2006).

Waste management in contemporary times should be seen as contributing to various other sectors as well. For instance, the Millennium Development Goals advocate inclusive policies in waste management to recognise role of the informal sector to improve collection coverage for better health conditions and finally, to invite partnerships with private formal actors and communities, who will further improve governance (UN Habitat 2010).

In today's times, India is witnessing a very crucial stage where there is a lot of focus on governance through local self-government and at the same time urbanisation is showing astonishing trends. At this point, tapping the potential of increasing citizen's networks for delivery of municipal services can be a promising platform.

The main objective of this paper is to highlight the various initiatives undertaken in Bengaluru with respect to solid waste management and discuss in detail some best practices, which have been successfully replicated in different parts of the city and have created lot of active volunteers, entrepreneurs that have also created a lot of employment opportunities.

The paper is structured into three sections. The first section deals with various initiatives across the whole process of SWM and their impact have been highlighted. This is followed by a discussion over three significant best practices, which have been successfully replicated in the city and have been instrumental in promoting sustainable waste management. The last section concludes by highlighting the main findings of the paper.

Research Methodology

This study is the documentation and classification of various initiatives undertaken along the different phases of the process of MSW in Bengaluru starting from awareness, segregation, collection, transportation, treatment and disposal. The data has been collected through various secondary sources and is also based on field observations.

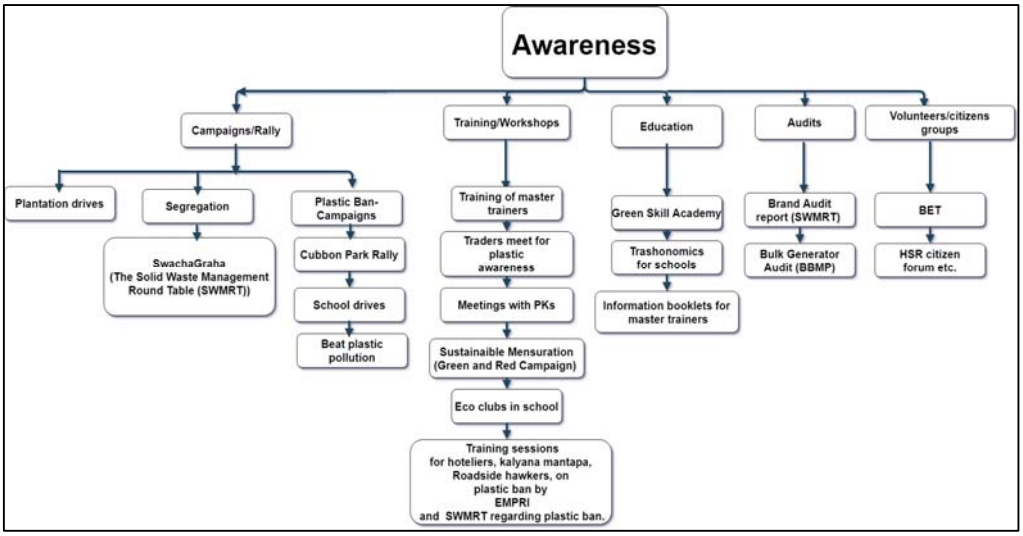
Solid Waste Management and Initiatives

For the purpose of simplification, we have classified various initiatives undertaken with respect to solid waste management according to the different phases of the waste management process done in the city starting from awareness, segregation, collection, transportation, processing and final disposal. These initiatives have been compiled and discussed based on field observations. BBMP report on sustainable waste management and best practices have also been referred.

Awareness

Citizens groups, as well as BBMP, have been the crusaders of awareness campaigns with respect to SWM in the city. Ranging from segregation, composting to 'beat plastic pollution' campaigns, a variety of innovative campaigns have been designed and implemented in the city. Some of these, as indicated in Image 1 below, include, segregation-focused campaigns like SwachaGraha, school drives and Cubbon Park rally for anti-plastic campaigns. A lot of training workshops have been conducted to create awareness among traders, hawkers, hoteliers, restaurant owners and street vendors over plastic ban and various alternatives to it. Periodical meetings with Pourakarmikas were held to help them understand segregation and plastic ban. Eco-clubs have been formed across schools, which are aimed at shaping young minds towards sustainable waste management practices. Efforts have been made to introduce the concept of waste management in schools and in the same concern Solid Waste Management Round Table (SWMRT) framed a curriculum, namely Trashonomics, which aims to educate students about waste management. With a view to educate its staff members, BBMP has released information booklets and documents to train Master Trainers or citizen volunteers. A Brand-Audit was also undertaken by SWMRT to identify the biggest polluter in plastic packaging branded litter. The audit reported that around 61% of the total 12,000 pieces audited were multi-layered laminated packaging. The main aim of this audit was to identify types and quantity of Branded & Unbranded packaging with manufacturers name in plastic waste. BBMP had recently proposed to set up plastic-to-fuel plants where such multi-layered plastic packaging will be used. Over 200 citizen volunteer groups are working in Bengaluru with respect to waste management in the city, viz. Bangalore Eco Team, HSR Citizen's Forum, Yelehanka Eco Group, etc. These groups are active on various social media platforms and have brought transparency and accountability to the SWM system.

Image 1: Initiatives undertaken in Awareness in SWM process



Source: Field Observations

Segregation

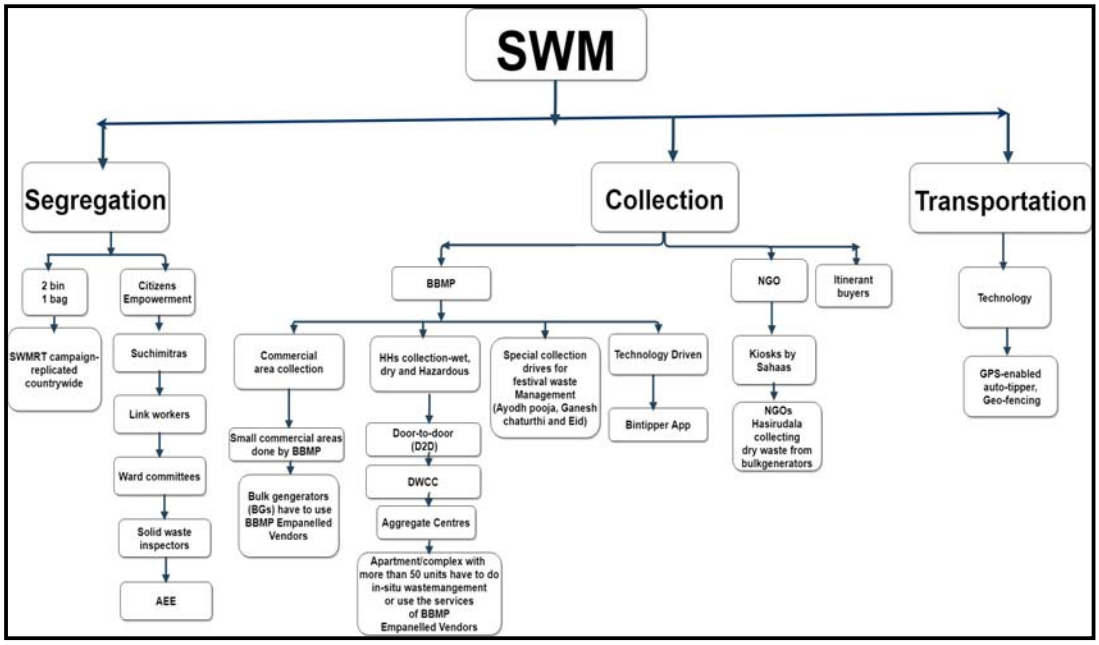
With respect to segregation, '2bin1bag' has been the most successful initiative and has even been replicated across the country. '2bin1bag' is a system to segregate waste at source. The Karnataka High Court on Dec 17, 2015 passed an interim order due to the ongoing PIL filed by SWMRT directing the citizens in Bengaluru to adopt this system. According to this system, 2 bins viz. green and red, are to be used for organic and reject waste respectively, while the bag is to be used to collect recyclable waste. More than two lakhs household have adopted this system in the city.

Image 2 below also indicates the initiatives undertaken in collection, which have been classified into three categories-- initiatives undertaken by BBMP, NGOs, and Itinerant buyers. Under BBMP responsibilities, wet waste is collected daily Door-to-Door (D2D) by a dedicated auto tipper while dry waste is collected bi-weekly by a separate auto and is taken to a Dry Waste Collection Centre (DWCC) where it is further segregated and sent for recycling. Separate arrangements have been made for bulk generators of waste like apartments, having more than 50 dwelling units. They are supposed to do in-situ arrangements for waste management, or take services from BBMP-empanelled vendors. Similarly, commercial bulk generators, which accumulate MSW of a quantity not less than 10 kg per day, are also supposed to do in-situ arrangements or take services from BBMP-empanelled vendors. Special arrangements are made to manage festival waste during Ayudha Pooja, Eid and Ganesha Chathurti. Efforts are made to introduce technology in the collection process. For instance, the BinTipper App will help keep a database of the quantum of waste collected daily by the auto-tipper.

Another significant stakeholder, which is playing a crucial role in SWM in the city are NGOs, Non-profit Organisations, and citizens group viz. Hasirudala, Sahaas, Janaagraha, Swachha, Bangalore Political Action Committee (BPAC), Solid Waste Management Round Table Bangalore (SWMRT), Hasirudala, Centre for Sustainable Development, Sahaas, Youth for Parivartan etc. For instance, Sahaas has its own recycling unit and have also come up with innovative e-waste kiosks installed at different locations in the city to help people dispose of there e-waste. Another NGO, Hasirudala helps bulk waste generators, like apartment complexes, to mange their dry waste. It has also played a pivotal role in helping the informal workers, rag pickers get official recognition from BBMP. Till date more than 7,500 rag pickers have been issued occupational identity cards. Likewise, many NGOs have come forward and are playing a significant role in creating awareness about segregation and are also reporting irregular collection to the concerned authorities. The role of informal sector in waste segregation and collection cannot be ignored. More than 15,000 waste pickers operate in Bengaluru who range from scrap dealers, municipal sweepers, itinerant buyers and dealers.

Transportation in SWM process is a very crucial link and includes auto-tippers, compactors and pushcarts. Efforts are being made to install GPS-enabled compactors to monitor their movement to processing plant and landfills. Geo-fencing for auto-tippers is also being explored to monitor their movements.

Image 2: Initiatives in Segregation, Collection and Transportation in Bengaluru



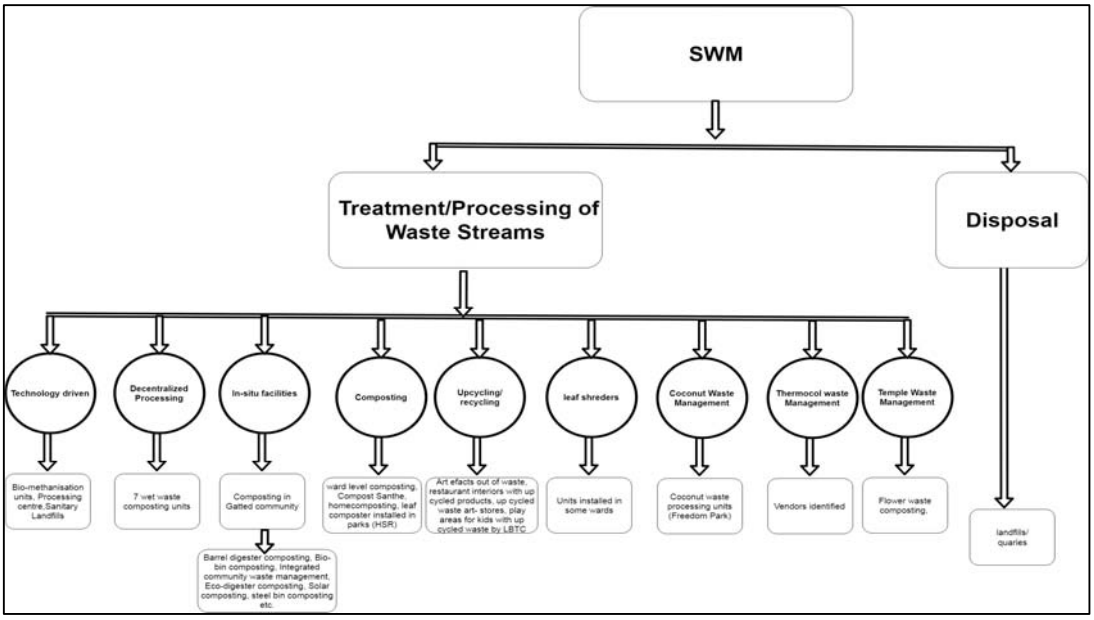
Source: Field Observations.

Treatment/Processing

Based on waste streams, different treatment/processing facilities have been set up for decentralised waste management like bio-methanisation units, seven processing centers, Sanitary Landfills. Ward-level composting, Compost Santhe, home composting, leaf composter installed in parks are also been promoted. In case of in-situ facilities, barrel digester composting, bio-bin composting, integrated community waste management, eco-digester composting, solar composting are common. Leaf shredder units have also been installed in some of the wards. Coconut waste processing units have been installed in the city and thermocol waste processing units have been proposed. Special composters have been placed in the premises of some of the temples in the city for in-situ management of waste. A lot of retail stores, with upcycled products, are becoming popular in town. Even a restaurant in the city has been designed using upcycled products.

Regarding waste disposal, the city of Bengaluru relies on its three landfill quarries. Recently, BBMP has proposed the appointment of clean-up marshalls to monitor these landfills. These marshals will be ex-servicemen with the state government and will be trained.

Image 3: Initiatives in Treatment and Disposal of Waste in Bengaluru.



Source: Field Observations.

Image 4 below discusses some of the interesting initiatives taken in waste management in general. In order to promote zero waste events, a lot of events like seedball events, green weddings, terrace gardening have been organised in the city. Seedball events mainly focus on increasing the green cover and involve golf-ball sized mixture of seeds, soil and compost, which can be easily scattered to grow trees in suitable places. Green weddings promote avoidance of disposable cutlery, single-use plastic and decorative items, etc.

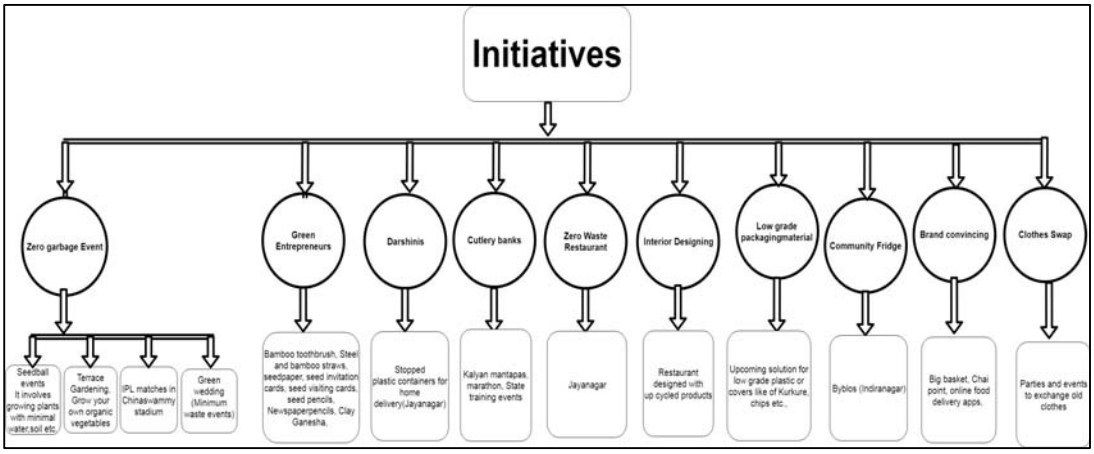
The city is also witnessing the wave of terrace gardening where people are been encouraged to use the compost generated at home in their own garden itself. Focus is also laid on making public events organised in the city, like IPL matches and marathons, totally zero-waste events by avoiding plastic water bottles, avoiding usage of flex banners etc. Some restaurants across the city have stopped usage of plastic containers for home delivery and are also offering discounts when customers carry their own boxes from home.

Cutlery banks across the city have mushroomed to promote usage of steel cutlery and avoid plastics and disposables. Another interesting segment, which has emerged, is that of Green Entrepreneurs, which offer products like bamboo toothbrush, steel and bamboo straws, seed papers, seed pencil, newspaper pencil and clay & seed ganesha etc. Some of the restaurants in the city have designed their interiors with upcycled waste and have opened new opportunities in sustainable interior designing.

Some of the commercial areas have set up community bins, where the extra food prepared at the restaurant is put in small fridges installed on the streets and the poor people can access it for free. Some of the private brands like Chai Point and Big Basket have also adopted sustainable practices. Chai Point took initiative to collect the used tea and coffee powder generated across their stores and share it

with farmers for use in vineyards. Big Basket has extensively worked on its packaging and has reduced the usage of plastic and cardboard boxes. These brands worked with some of the citizen's volunteers in the city to adopt green practices.

Image 4: Initiatives in Solid Waste Management



Source: Field Observations.

Based on the above discussion about various initiatives undertaken in waste management in Bengaluru, this study has chosen two best practices and one case of eco-innovation, which have been replicated in the city extensively and successfully. This includes plastic ban and composting. These initiatives have, in turn, stimulated a series of new initiatives in the city like cutlery banks, edible cutlery, terrace gardening and 'Oota From Your Thota' events. The eco-innovation case discussed in this section is about a venture called, Daily Dump, where composting was made easy with the use of technology.

Case Studies

Case Study-1 Compost Santhe

The credit for composting revolution in the city goes to citizen-led campaigns like SwachaGraha. The revolution gained momentum as citizens learned simple benefits of home composting and how they can influence the management of organic waste in the city. Experts like N S Ramakanth and Vani Murthy made the story of composting reach a large number of households in Bengaluru. With a vision to promote decentralised composting, BBMP, along with citizen volunteers, started Compost *Santhe* in the city with an aim to promote and give live demonstrations on composting to citizens to manage their organic waste at home itself. Till date, 28 compost *santhe* have been organised in the city. BBMP aims to conduct these Santhe's in all 198 wards of the city. These *santhe* are a kind of flea markets where easy and convenient solutions are given to participants through experts and entrepreneurs in composting. There are several vendors for composting, which display and sell associated products to enable composting while the citizen-volunteer educate the public. Some of the other stakeholders, who play a very crucial role in organising a Santhe, are the Corporators and MLAs of the respective ward who actively participate in organising this event. Efforts are also been made to connect with farmers of

nearby areas so that the compost generated in the city can be directly sold to the farmers without any intermediaries at a nominal rate. The venue for a Santhe is usually arranged by BBMP and mostly public parks are selected for the same. Once a santhe is planned it is usually advertised through newspapers, social media platforms like Watsapp groups, Facebook, etc. Some of the main themes around which the compost santhe is usually organised are 2bin1bag, SwachaGraha, Green The Red, Trashonomics and Plastic Ban. These themes are presented in the form of citizen awareness stalls and vendors of associated products sell their products at the venue. Apart from this, stalls exhibiting upcycled/recycled products, bio-enzymes, Rent-A-Cutlery, Restore (encouraging restage of articles rejected by his/her neighbor), mensurational hygiene products, pencils from recycled newspapers, khamba pots are some of the attraction in a santhe (TOI 2017).

Impact of Compost Santhe

Compost Santhe's have now emerged as a platform to educate and create awareness among citizens about sustainable waste management. At the same time it is now a crucial part of BBMP's Clean Bengaluru Campaign. These Santhes not only provide people with easy solutions for composting but also provide one-stop solutions for there gardening needs. One of the very significant impact of these santhes has been that they have led to the wave of OTG (Organic Terrace Gardening) and OFYT (Oota From Your Thota) movements in the city. People have now started growing organic vegetables for their own consumptions in their balcony and rooftops using the compost generated in their household itself. Around 28 OFYT events have been conducted so far in the city. These events are focused on helping people understand as to how they can start there own organic vegetable garden by conducting seminars and workshops, selling saplings and other gardening tools. During organisation of compost santhe or OFYT events, special emphasis is laid on making them zero waste events by avoiding plastic completely and the food stalls in these events strictly adhere to steel cutlery and water stations. Sometimes school children also help organise such events, thus, spreading the message of sustainable waste management to the younger generation. Children often put up stalls selling saplings. School students, both from private and public institutions, are often roped in to conduct cultural events. One of the compost santhes in HAL even popularised the concept of "Chinnari Thota" which aimed at educating school children to grow their own food (Deccan Chronicle 2017). The compost santhe organised at Sanjaynagar saw 35 organisations, including the Alappuzha Municipality, Kerala, participating in the event (The Hindu 2017). Other service providers at the santhe include Shudh-Labh, Hasirudala, Biome and Smart Bin (Deccan Herald 2017). In fact, now special platforms have come into existence where people can sell their extra compost or bio-enzymes. Another important point, which cannot be ignored due to organisation of such events is that, people have become more sensitive about their responsibilities and are ready to go that extra mile to keep their city clean.

Today Compost Santhe is seen as a transformation platform for citizens wherein they adopt sustainable practices for waste management and at the same time these events also represent the city's achievement in waste management.

Case Study-2 Plastic Ban

Out of the 4,000 tonnes of plastic which is generated everyday in Bengaluru 350-400 tonnes is plastic waste. Plastic items, like carry bags, not only have long-term environmental consequences but also pose as a health hazard to all living beings on the planet. Plastic waste often block drains, gutters sewers and pollutes the urban water bodies. Considering such detrimental problems, the State Government of Karnataka under the Environment (Protection) Act, 1986, issued a notification on March 11, 2016 banning manufacture, supply, sale and use of plastic carry bags, plastic banners, plastic buntings, flex, plastic flags, plastic plates, plastic cups, plastic spoons, cling films and plastic sheets used to cover dining tables, including the above items made of thermocol and plastic, which use plastic micro beads in the state. Later, through a correction notification, plastic straws and bags made from compostable plastic material were also put under the banned category. Everyone including the shopkeeper, vendor, wholesaler, retailer, trader, hawker or salesman can use any of these. However, there are certain exceptions like plastic bags manufactured exclusively for export purpose, plastic bags used in Forestry and Horticulture nurseries, plastic used for packing milk and milk products, plastic used for packaging in which goods are sealed prior to use at manufacturing/processing units. Apart from this, a document explaining alternatives to various plastic commodities used in daily life was released.[1] Notifications, regarding imposition of penalty for manufacturers, hoarders, traders and users of banned plastic items, have also been released.

Though the time period, immediately after plastic ban, was a little sluggish, in terms of implementation of the ban, in in recent times the BBMP has taken measures to strictly enforce it. Some of the significant measures taken in this regard include plastic seizing activities and fine collection in commercial areas, which are being conducted till date, have turned out to be an important milestone in successfully implementing this ban. A number of training sessions have been organised for street vendors, hawkers, hoteliers and Kalyan Mantapa owners over educating them about the recent ban and the alternatives to plastic. Samples are shown to the audience in these sessions and they are helped to identify plastic and non-plastic material. These sessions are been jointly conducted by BBMP and EMPRI (Environmental Management and Policy Research Institute) Bengaluru. Special attention has been laid on avoidance of single-use plastic and buying of packaged mineral water plastic bottles. Karnataka State Pollution Control Board (KSPCB) has taken measures to ensure that all producers of plastic and companies that use plastic for packaging their products should register themselves with KSPCB. In this regard KSPCB even organised meeting of large-scale producers (The Hindu 2017a). The chairman of KSPCB even visited plastic manufacturers in Kamakshipalya, Peenya, and surrounding areas to check their compliance with the plastic ban (The Hindu 2016).

Impact of Plastic Ban

As a global host to World Environment Day 2018, India adopted the theme of Beat Plastic Pollution and hence the activities against the plastic ban gained a lot of momentum. Special anti-plastic awareness drives, campaigns, rallies etc. were conducted at strategic public places like Cubbon Park, government

[1] Annexure -1

offices, schools, etc. The city saw some of the supermarkets replacing their plastic bags with brown paper bags, newspaper bags and cloth bags. In fact, a lot of entrepreneur have emerged offering innovative cloth bag designs to carry multiple segregated vegetables in a single bag. A number of NGOs, Self -help groups and vendors have come into existence which manufacture cloth bags and have opened up a lot of employment opportunities. Many citizen volunteers are actively engaged in creating awareness over plastic ban and in promoting the usage of its alternatives. Alternatives in the form of bamboo toothbrush, steel and bamboo straws, cutlery banks, edible cutleries are catching up in the city. BBMP aims to have one cutlery bank in every ward with an objective of replacing disposable cutlery, which is usually made of plastic or thermocol. Some of these cutlery banks work on charity basis while others charge a nominal fee. Special instructions have been laid down for Kalyan Mantapas in the city to have their own steel cutlery and a commercial dishwasher.

In order to study the impact of plastic ban and to identify the top polluters, a Brand Audit was done by Solid Waste Round Table Conference (SWMRT) in eight locations in Bengaluru. The activity was pan-India and was coordinated with GAIA (Global Alliance for Incinerator Alternative). The audit involved 120 volunteers and groups like HasiruDala, Bangalore Eco Team, HSR Citizens Forum, Beautiful Bengaluru, Lets Clean Bengaluru, Kasa Muktha Bellandur, Yelahanka Eco Group, Lal Bagh West Group and Swachha. Out of the 12,000 pieces audited it was found 61% of them were multi-layered laminate packaging which are non-recyclable. This audit brought the attention of all key stakeholders to target the multi-layer packaging in order to make the plastic ban effective. Some of the top polluters include food packaging industry, personal care packaging and household products packaging.[2]

All these efforts undertaken clearly indicate the city's dedication towards reducing the usage of plastic.

Case Study 3- Daily Dump

'Daily Dump' is a unit that manufactures eco-friendly composter models for making compost. Daily Dump provides a series of products that are of unique design to suit local conditions by using locally available material, low-cost, space-effective and aesthetically appealing. In India, there were no commercial home composters available until the launch of Daily Dump. Waste-to-Wealth is possible thereby reducing the burden on the environment and the economy. It reiterates the fact that awareness and by being consciously responsible, it is possible to set up locally sustainable frameworks. Given its interesting features, there is large scope for replication in the urban context, particularly, among the upper class and middle class households, besides, supporting local livelihoods and promotion of hygiene. Daily Dump is actively involved in promoting this interesting concept by creating a series of awareness programmes about the method, approach and technology and sales of its products. Interestingly, the income generated by sales is used to enhance support for the potters' community who make the composting units, sale and distribution of products across cities, research and to escalate the spirit of composting. It makes the citizens responsible, involves NGOs to promote awareness, besides promoting livelihoods and green entrepreneurship, thus aiding the local government. Daily Dump has

[2] Annexure 2

been catering to residents living in individual homes, flats, communities, schools and offices. It has a service backup facility along with customer support, which makes the whole process feasible and convenient. Being an exclusive design that suits local conditions of cities in developing countries, where the calorific value of waste is low, Daily Dump can be a sustained design initiative.

There are several models that include garbage-composting units, leaf-composting units designed to suit specific leaf types and culture-friendly composting units that can be used to process flower waste generated after the religious rituals every day. Daily Dump has a range of Terracotta products ('Khamba' and 'Leave it Pots' in varied forms and sizes and can be installed in small spaces of just 2 sq. feet. Community composting units (Manthans) are designed in a way to function without electricity or chemical additives. Daily Dump also provides a range of monthly and one-time service plans to aid customers with easy and effective maintenance of composting units.

The products are designed well to make it visually appealing as it is made of earth, close to nature. Owning and handling the process of waste-to-resource is a journey and users have expressed a sense of satisfaction to have contributed less to the city's garbage and helped in improving the city's healthy environs.

Converting waste-to-resource aids the environment considerably by reducing land and water pollution. Daily Dump products divert 60 per cent of trash from reaching the landfill. On an average, an Indian home produces organic waste of ½ to 1.5 kilograms per day, which is about 30 kilograms a month. Composting generates about 12 kilograms of compost every two months. Daily Dump so far has enrolled 26,000 Daily Dump users across Bengaluru, Chennai, Mumbai, Pune, Hyderabad and Delhi and has been able to keep away around 15,000 kgs of organic waste from the landfills each day.

Dry waste collection for resale value is a livelihood option for more than **30,000 rag pickers** and informal sector recyclers in Bengaluru city. Segregation at source will help wet waste and dry waste separate, making it more accessible and usable to the recycling community.

Daily Dump trains potters to make composters with a buyback facility and sold through different mediums -- shops, online stores, outlets across cities and organic exhibitions. The communities of potters, who make Daily Dump products, have doubled their turnover within a short span of two years by making the products. They have been able to have a stable market along with working capital, which is interest free.

The local City Corporation (Bengaluru Mahanagara Palike) spends more than Rs 4 crores ($ 587,154) to collect, transport and dispose municipal waste annually. This is a huge expenditure that can be diverted for more productive uses to improve the city. Promoting Daily Dump can aid in reducing expenditure on waste management as a significant amount of waste can be put to use in a resourceful manner.

Daily Dump offers business opportunities by providing clone models, which is open to others for duplicating the business. Designs are open source indicating that anybody could locally produce and sell the products by paying a small royalty fee, thus encouraging micro enterprises. There are 21 clones in Bengaluru city and 17 clones across different cities in India which is an interesting concept that is getting popular to promote related green services, thus, promoting ethical and conscious consumer behaviors. Trash Trails have also been organised by the Daily Dump team to educate more people and

influence them to convert garbage into compost. Trash Trails are practical in nature with hands-on seeing, discussing, debating, observing, questioning, understanding and learning experience, hence, makes it interesting for the participants. It is about influencing behavioural change.

Challenges for Daily Dump

The mindset of the people is a matter of concern and a challenge. Majority of the people believe waste management has to be the responsibility of the government. Also, most urbanites are not aware that composting can be done at home. Lack of space is another reason, as they do not have open space/garden space. Composting at home is avoided due to the fear of attracting rats, dogs besides the bad smell that attract flies and mosquitoes. Composting is considered non-doable given their busy schedules. Daily Dump team works hard to break down all the possible barriers and excuses of the people so that they adopt waste management. People do not get convinced easily. It needs enormous commitment, dedication and perseverance to ensure that people adapt to newer ways of doing things.

It is important that there is proper back up facility set up to see the success of the programme; else it would easily fall apart. People do not like to face any inconvenience and keeping in view all their cultural and belief systems is challenging. People need reassurance that someone will come and look after the composter and attend to all the issues concerned.

The team faces the challenge of creating sustainable revenue streams for all the research and design work that has been invested upon. The team is working on possibilities of working with NGOs to network and enable waste to be managed all over the city and country as well. To upscale the idea, several options are being explored since Daily Dump has a robust design and an easily replicable model that can be adapted by most people all over India.

Commitment to change is important and addressing challenges is for a lifetime. Perceiving waste in a different light is how the issue has been pursued. The informal recyclers are considered as green warriors and they take business risks by being entrepreneurs. Recycling is important and Wipro, the software company, mentioned that they have engaged 1-lakh employees in waste management alone. Hence, to see impact on society, recycling has to be facilitated and implemented meticulously. Equipping and empowering the recyclers, named, as ‘recycle gurus’ , have to be provided with platforms that enable them to understand what the customers seek. The business is looked at closely, keeping in mind, all stakeholders, how best can the recycler benefit, customers benefit and also how the city could benefit. In summation, waste is not seen as waste but a misplaced resource.

Inventor of Daily Dump, Poonam, views that the point is to contribute towards ‘commons’ as solutions do not exist in legacy mindset. Commons are to be entwined into sustainable business models, where commons get a new lease of life. While the government wants to dump the garbage into the farthest village, scientists have to invest crores into making the technology work, while at the ground level, people are segregating waste already, hence, emphasis has to be on intertwining the commons.

Solid Waste Management and Challenges Ahead

Despite a plethora of initiatives and events to promote efficient waste management in the city there are a lot of challenges ahead. Presently, there are five solid waste management-processing projects of BBMP. Out of these five projects, four projects have 1,900 MPTD of plant capacity while the fifth plant, with the capacity of 250 MPTD, is under pilot run. Out of the remaining four plants, only three are receiving a total of 700 MPTD of wet waste. Given that the city generates a total of 5,758.17 TPD of waste across small residential, commercial establishments, street sweeping, including bulk generators, 64% of this accounts for wet waste produced in the city on a daily basis. Followed by 28% of dry waste, 3% of domestic hazardous and 6% of reject/inert waste, the city has a long way ahead to efficient waste management and probably this justifies why waste management in the city is a moot point. A point to note here is that there is no data available in public domain about the amount of waste collected and transported to processing plants or landfill sites. This probably also indicates why there are numerous illegal garbage disposal sites and black spots in the city. However, a study by Ramachandra *et al,* 2018 indicates that the proportion of municipal solid waste collected by the agencies disposed at identified sites is 60% while the remaining is disposed of at unidentified sites. Feasibility of alternatives, like waste-to-energy, is questionable given the high moisture content of waste as wet waste is higher in proportion in the city. Also the city still doesn't have a complete waste segregation model at source. The bio-methanisation model has been initiated in a few wards, however, its potential as a decentralised waste processing system is at a nascent stage.

Findings

The city has witnessed a lot of initiatives with respect to the whole process of waste management. Some of these have turned into success stories and have been replicated, not only in the city but also nationwide. A key finding of this study is that all initiatives and success stories in the city had extensive stakeholders' participation, viz, citizens, municipal authorities, central and state governments, NGOs, citizen volunteers and informal sector, etc. These initiatives have also brought in transparency and accountability in the system of waste management in the city. Another interesting thing to note is that across the whole process of SWM, treatment and awareness have attracted a large number of initiatives while collection, transportation and disposal are the ignored phases or do not have any citizen's participation probably because transportation and disposal are solely in the hands of either BBMP or the private contractors. Waste collection has seen some private players and NGOs participation. A point to note here is that collection takes a major portion of the total budget of SWM in a municipality. According to a World Bank (2012) report, low-income countries tend to spend a major part of their SWM budget on collection, in some cases it being 80 to 90%, while almost ignoring disposal. The collection efficiency still remains very low in low-income countries.

Conclusion

Though there have been a lot of policy initiatives, as well as citizens involvement with respect to solid waste management in Bengaluru, however, all these initiatives and success stories are mostly isolated and cater to only a small area or group of people and have been quite successful as well. Hence, an integrated approach towards waste management is the need of hour wherein all stakeholders and these initiatives are woven into the urban fabric to achieve a holistic and sustainable solution to the garbage menace. As far as collection and disposal are concerned, very few initiatives have been undertaken and also there is absence of stakeholders other than BBMP and private contractors. In case of treatment, it can be seen that citizen's groups have come up with innovative ideas but the waste treated through these initiatives forms a fraction of waste actually treated in the city. Rest of the unsegregated waste still goes to fill quarries. The need of the hour is to have operational sanitary landfills for the city, and to make efforts for usage of technology throughout the process of SWM, especially to track the transportation of waste.

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Appendices

Annexure-1

Alternatives to Plastic

Source: BBMP 2018

Annexure-2

Brand Audit (SWMRT)

Source: Brand Audit Report 2018

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