Centre for Peace and Development Initiatives

Punjab's Waste Woes:

A Look at Solid Waste Management, Sanitation, and Water Supply

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Research and Author/s: Ahmad Iqbal Chaudhary, Atta Ali Malik and Osama Ahmed

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Acronyms

ADB	Asian Development Bank
CAPEX	Capital Expenditure
CDM	Clean Development Mechanism
CER	Certified Emission Reduction
DHA	Defense Housing Authority
DWASA	Dhaka Water Supply and Sewerage Authority
GDP	Gross Domestic Product
GHG	Greenhouse Gas
LG&CDD	Local Government & Community Development Department
MOCC	Ministry of Climate Change
MSW	Municipal Solid Waste
MT	Metric Ton
NDCs	Nationally Determined Contributions
PKR	Pakistani Rupee
PLGA	Punjab Local Government Act
UNFCC	United Nations Framework Convention on Climate Change
USD	United States Dollar
WMCs	Waste Management Companies
WHO	World Health Organization

Introduction

Punjab is the largest province of Pakistan by with a population of 110 million spread across an area of 205,433 sq km and a population density of 540/sq km. According to the 2017 Census, 37% of the population is classified as urban, while the remaining 63% is classified as rural.

Table 1: Key Population Facts

	Population (mm)	Urban	Rural	Area (sq km)	Density (per sq km)
Bahawalpur Division	11.45	25%	75%	45,588	251.22
D.G. Khan Division	11.02	17%	83%	38,778	284.21
Faisalabad Division	14.19	37%	63%	17,918	791.67
Gujranwala Division	16.12	37%	63%	17,207	936.88
Lahore Division	19.39	31%	69%	11,727	1,653.44
Multan Division	12.27	28%	72%	15,211	806.53
Rawalpindi Division	10.00	41%	59%	22,254	449.66
Sahiwal Division	7.38	22%	78%	10,304	716.18
Sargodha Division	8.17	25%	75%	26,360	309.83
Total	109.99	37%	63%	205,433	535.63

Source: Pakistan Bureau of Statistics, 2017

Lahore is the largest city in Punjab by population, with a population of 11 million, followed by Faisalabad (3.2 million), Rawalpindi (2 million), Gujranwala (2 million), and Multan (1.8 million). The nine largest cities in Punjab[1] together constitute around 21% of the province's population (23 million). The remaining 17 million of the urban residents in Punjab live in smaller cities and towns ("towns and cities with populations below 400,000")[2] while the vast majority of the population (69 million) lives in rural villages throughout the province. [2][3]

Overview of the Waste Problem

According to recent estimates, Pakistan generates approximately 30 million metric tons of municipal solid waste (MSW) per year, and this amount is expected to increase due to population growth, urbanization, and economic development. Around 50% of this waste is

[1] Metropolitan Corporations
[2]Source: Pakistan Bureau of Statistics.
[3]Rural population falls under the jurisdiction of respective District Councils.

collected through formal or informal arrangements, but the collection rates vary widely by location, with higher rates (80%) in larger cities to lower rates in rural areas (Mihai and Grozavu, 2019).

Pakistan has almost no managed landfill sites for waste disposal, and currently has zero capacity for sanitary waste disposal. All collected solid waste in Punjab is simply dumped in open sites. The country's current system of municipal waste management is inadequate, with services provided primarily by municipalities and limited to partial collection and open dumping or burning. A reliable national study has not been conducted to determine the overall quantity of waste generated in the country, but to get an idea for development road map estimates drawn from various sources are shown in Table 2.

Source: ADB, 2022 and Author's estimates

Table 2: Waste Generation Estimates

Typology	Waste Generated (kg per capita)	Waste Generated (MT per year)	Collection (% of generated)	Disposal (% of collected)
Large Cities	0.55	9.44	80	0
Mid and small sized cities	0.42	4.44	50-70	0
Rural communities	0.33	13.72	<20	0

The poor state of sanitation and hygiene practices in Pakistan has had significant consequences on various aspects of life, including premature deaths, economic and financial costs from diseases caused by poor sanitation, environmental costs, and other welfare costs. For example, as of 2006, only 50% of sewage was collected nationally (with only 20% collected in rural areas), and only 10% of sewerage was effectively treated. There were only a few treatment plants in the country, and many of them were not fully functional.

In 2006 42% of the population in Pakistan had access to unimproved toilet facilities, and 11% had access to shared or unimproved facilities. Approximately 50.1% of households had access to improved toilets, with 55.8% having a sewer-connected flush toilet and 29.1% having a septic tank-connected flush toilet. Approximately 50 million people (31%) defecated in the open, and an estimated 8 million people (5%) used shared toilets. When combined, these groups totaled 58 million people (36%) who either defecated in the open or had access to shared toilets.

These figures were published in Multiple Indicator Cluster Survey (MICS). The Multiple Indicator Cluster Surveys (MICS) is a global household survey program developed by the

United Nations Children's Fund (UNICEF) to provide internationally comparable data on the situation of children and women. MICS surveys are conducted every 5-6 years in over 100 countries, and collect data on a wide range of indicators including child mortality, education, nutrition, HIV/AIDS, water, and sanitation. The MICS surveys use standardized questionnaires and sampling methods to ensure that data collected are comparable across countries and over time. The MICS program aims to improve the availability and use of data to inform policies and programs for children and women.

There were significant rural-urban disparities in access to improved sanitation: while 90% of the urban population had access to improved sanitation facilities (that is, the kind that hygienically separates human excreta from human contact), only 40% of the rural population did. In rural areas, 45 percent of the population still practiced open defecation. The total economic cost of poor sanitation in 2006 was estimated at 343.7 billion PKR(equivalent to US$5.7 billion or 3.94% of GDP). Of this cost, 69.52 billion PKR (equivalent to US$1.15 billion or 0.8% of GDP) was the direct financial cost.[4]

Table 3: Urban-Rural Water Sanitation Resources

	MICS 2018			MICS 2014		
All source of drinking water %	Urban	Rural	Total	Urban	Rural	Total
Piped into dwelling	15.1	3.8	7.9	25.8	4.6	11.6
Piped into compound, yard or plot	4.0	3.9	4.0	1.9	1.7	1.8
Piped into neighbor	1.9	1.7	1.8	1.1	0.8	0.9
Public tap/ Standpipe	7.8	3.5	5.1	10.3	2.6	5.1
Tube well	0.9	1.1	1.0	0.9	0.7	0.8
Hand pump (Mechanical)	7.2	35.7	25.3	8.6	41.5	30.6
Motorized pump (donkey/Turbine)	34.1	39.5	37.5	38.2	43.4	41.7
Tanker-truck	0.6	0.2	0.3	0.3	0.1	0.3
Cart with small tank/drum	24.9	7.2	13.6	8.9	1.7	4.1
Protected well	0.5	1.0	0.8	0.5	1.1	0.9
Protected spring	0.1	0.2	0.2	0.1	0.4	0.3
Bottled water (mineral)	1.1	0.1	0.5	1.6	0.1	0.6

[4]Water and Sanitation Program (WSP), 2012

Improved Water	98.2	97.9	98.0	89.1	96.8	94.3
Unprotected well	0.1	0.5	0.3	0.0	0.3	0.2
Unprotected spring	0.1	0.2	0.1	0.0	0.2	0.2
Surface water (river, stream, dam, lake, pond)	0.4	0.9	0.7	0.1	0.2	0.1
WATER KIOSK	0.8	0.1	0.4	0.8	0.1	0.4
Other	0.4	0.4	0.4	1.5	0.7	1.0
Unimproved Water	1.8	2.1	2	10.9	3.2	5.8

Understanding Challenges: Waste, Sanitation and Clean drinking

Water Filtration

The quality of drinking water in Punjab is rapidly deteriorating, leading to a range of water borne diseases caused by microbes and contaminated chemicals. Water filtration plants are critical for providing of clean water supply, and the Punjab Government has launched several initiatives to install these plants in various districts. Local governments have also contributed to the installation water filtration plants in their areas. According to data available from Local Government and Community Development Department estimates, there are 1,307 filtration plants in Punjab but an estimated 2,053 more are needed. Of the existing plants, 197 plants are non-functional and require an investment of approximately PKR 230 million for repair. The planned installation capacity is insufficient, with a plant serving a population of approximately 50,000.

Table 4: Water Filtration Plants - Existing and Planned Capacity

District	Existing Filtration Plants	Filtration Plant Capacity Planned	Existing Planned Capacity/person	Planned Capacity/ person
Bahawalpur	57	77	64,372	47,652
Bahawalnagar	19	47	156,613	63,312
Rahim Yar Khan	102	188	47,135	25,573
DG Khan	1	9	2,872,631	319,181
Rajanpur	18	37	110,891	53,947
Layyah	8	25	227,999	72,960
Muzaffargarh	50	130	86,571	33,297
Tobatek Singh	14	31	156,535	70,693
Jhang	23	59	119,245	46,485
Faisalabad	132	159	59,715	49,575
Chiniot	13	20	105,281	68,433
M.B. Din	25	41	63,762	38,879
Gujranwala	61	89	82,149	56,304
Gujrat	87	89	31,681	30,970
Hafizabad	26	43	44,498	26,906
Narowal	225	225	7,589	7,589
Sialkot	53	88	73,489	44,261
Shiekhupura	11	27	314,546	128,148
Nankana Sb	7	30	193,569	45,166
Lahore	40	-	22	-
Kasur	206	33	303	104,693
Vehari	125	90	145	32,245
Khanewal	91	119	101	24,450
Lodhran	61	-	45	0
Multan	35	7	84	678,024

Chakwal	40	60	42	24,924
Rawalpindi	30	125	52	43,219
Attock	75	35	122	53,897
Jhelum	58	20	68	61,120
Sahiwal	51	10	76	251,301
Pakpattan	124	65	389	28,065
Okara	137	23	280	132,210
Khushab	45	13	34	98,490
Bhakkar	69	38	48	43,365
Mianwali	83	100	40	15,426
Sargodha	113	175	100	21,121

Note: Excluding Cantonment Boards, Private Housing Societies and jurisdictions governed exclusively by Development Authorities.

There is significant regional disparity in clean water coverage in Punjab. Central Punjab, which has a population of approximately 59%, has 74% of total filtration plants. Meanwhile, North and West Punjab, which have a combined population of 18% (10% and 8% respectively) only have a total of 7% of installed filtration plant capacity. This disparity in access to clean water is a major concern and efforts should be made to address it through targeted investments and infrastructure development in under-served regions.

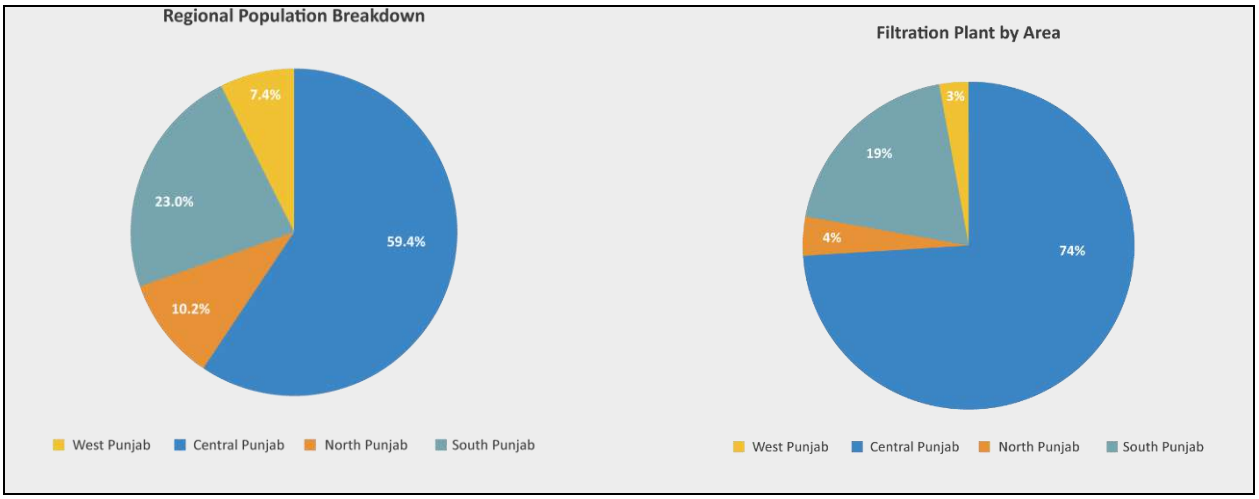

Figure 1: Population & Water Plant Breakdown by Region

Central Punjab has a significantly higher number of filtration plants compared to Northern and Western Punjab, with one plant serving a population of 59,800 people in Central Punjab compared to 212,907 and 200,374 in Northern and Western Punjab, respectively. The planned installed capacity by the Government of Punjab will slightly improve this situation, with populations of Northern and Central Punjab having a filtration plant for around 80,000 people, and those in Central and Southern Punjab having water filtration plant coverage for a similar population size. While part of Northern Punjab discrepancy can be explained by large water filtration facility at the dams providing water to most of the region.

Table 5: Water Filtration Capacity - Regional				
Region	Existing Plants	Planned Capacity	Population served/plant	Population served/plant - Planned
Central Punjab	969	1326	59,884	43,761
North Punjab	47	126	212,907	79,418
South Punjab	255	513	88,133	43,809
West Punjab	36	88	200,374	81,971

Despite some progress, many areas of Punjab still lack effective clean water coverage. The province's only mega city, Lahore, has government installed water filtration plants serving a population of approximately 112,000 per plant. While private housing societies, cantonment boards, and the Defense Housing Authority have also installed some water filtration capacity, the majority of the population is left without access to a filtration network. As a result, middle- and upper-income segments often rely on bottled water as their main source of drinking water. This highlights the need for more comprehensive and inclusive clean water infrastructure and policies to ensure all residents have access to safe, clean drinking water.

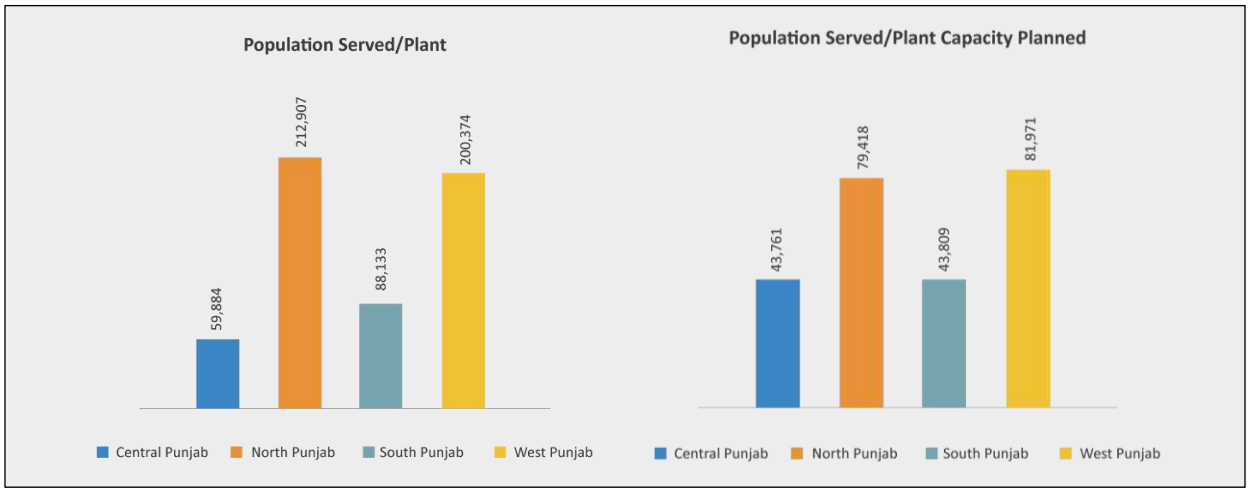

Figure 2 Source: Govt of Punjab estimates, 2022

There is significant variation in the installed capacity of filtration plants among districts in Punjab. According to the coverage data of water filtration plants, Narowal has the highest capacity, with each plant serving 7,589 while Bhakkar has no functional filtration plants at all. Rahim Yar Khan located outside Central Punjab, is the only district in the top 5 districts for water filtration coverage. This uneven distribution highlights the need for targeted investments and infrastructure development to address disparities and ensure all districts have access to clean water.

Sheikhupura, a district in Central Punjab, is among the worst performers in terms of water filtration coverage. Can also be seen in the list below. The bottom 5 list also includes two cities from South Punjab, and one city each from North and West Punjab. (Source: Govt of Punjab Statistics 2022)

Top 5 districts	
	Population Served/Plant
Narowal	7,589
Vehari	29,918
Gujrat	31,681
Hafizabad	44,498
Rahim Yar Khan	47,135

Worst performing 5 districts	
	Population Served/Plant
Sheikhupura	314,546
Mianwali	385,650
Rawalpindi	491,125
DG Khan	2,872,631
Bhakkar	None

Figure 3 Best/Worst Performing Districts/Plants

Case Study: Water Filtration

Introduction:

Access to clean drinking water is a critical issue in Pakistan, with many rural and urban areas suffering from water scarcity and water contamination. This has led to a range of health problems, including outbreaks of waterborne diseases such as cholera and diarrhea. In order to address this problem, it is important to implement effective water filtration technologies that can improve the quality and accessibility of clean drinking water.

Case Study: Gujarat State, India

Gujarat State in India has implemented a range of water filtration technologies in order to address the issue of clean drinking water. One example is the use of reverse osmosis (RO) technology, which involves the use of a semi-permeable membrane to remove contaminants from water. RO plants have been set up in various parts of the state, including in urban areas such as Ahmedabad and Surat.

In addition to RO plants, Gujarat State has also implemented other water filtration technologies such as sand filters, activated carbon filters, and ultrafiltration systems. These technologies have been used in both rural and urban areas, and have helped to improve the quality of drinking water for millions of people.

Impact:

The implementation of water filtration technologies in Gujarat State has had a significant impact on the accessibility and quality of clean drinking water. According to data from the Gujarat Water Supply and Sewerage Board, the number of people served by these technologies has increased from 6 million in 2001 to over 20 million in 2020. This has led to a significant reduction in the incidence of waterborne diseases and has improved the overall health and well-being of the population.

Conclusion:

The case study of Gujarat State in India demonstrates the effectiveness of water filtration technologies in improving the accessibility and quality of clean drinking water. Pakistan could benefit from adopting similar technologies in order to address its own clean drinking water problem and improve the health and well-being of its population.

Waste Management

There is a significant divide in waste management practices between urban and rural areas in Punjab. While cities and large towns have some mechanical equipment for waste disposal, such as tractors, loaders, lifters, smaller urban units and low-income peripheries of large cities and towns) rely on manual arm rollers. Garbage collection containers are also only available in cities. One way to compare waste management systems in urban areas is to assess the container coverage for each district and region. This data can help to identify areas where additional resources or infrastructure may be needed to improve waste management practices and protect public health and the environment.

Table 7 Waste Management Equipment and Machinery by District					
	WM Machinery	WM Container	WM Manual Equipment	Machinery p.c.	Container p.c.
Bahawalpur	72	5	17	50,961	733,835
Bahawalnagar	66	65	22	45,086	45,779
Rahim Yar Khan	130	35	185	36,983	137,365
DG Khan	142	70	-	20,230	41,038
Rajanpur	97	15	160	20,578	133,069
Layyah	79	-	16	23,089	-
Muzaffargarh	118	24	85	36,683	180,356
Tobatek Singh	64	40	195	34,242	54,787
Jhang	107	186	102	25,632	14,745
Faisalabad	112	62	112	70,379	127,136
Chiniot	70	56	96	19,552	24,440
M.B. Din	65	22	34	24,524	72,456
Gujranwala	119	45	280	42,110	111,357
Gujrat	140	125	342	19,688	22,050
Hafizabad	55	43	138	21,036	26,906
Narowal	63	13	81	27,104	131,352
Sialkot	171	69	116	22,777	56,448
Shiekhupura	55	-	110	62,909	#DIV/0!
Nankana Sb	436	74	373	3,108	18,311
Lahore	40	-	22	278,000	#DIV/0!
Kasur	206	33	303	16,771	104,693
Vehari	125	90	145	23,217	32,245
Khanewal	91	119	101	32,090	24,540
Lodhran	61	-	45	27,864	#DIV/0!
Multan	35	7	84	135,605	678,024
Chakwal	40	60	42	37,387	24,924
Rawalpindi	30	125	52	180,079	43,219
Attock	75	35	122	25,152	53,897
Jhelum	58	20	68	21,076	61,120
Sahiwal	51	10	76	49,275	251,301
Pakpattan	124	65	389	14,712	28,065
Okara	137	23	280	22,196	132,210
Khushab	45	13	34	28,453	98,490
Bhakkar	69	38	48	23,882	43,365
Mianwali	83	100	40	18,586	15,426
Sargodha	113	175	100	32,710	21,121
Central Punjab	1,973	680	3,007	28,712	67,869
North Punjab	203	240	284	49,294	41,694
South Punjab	704	214	485	31,923	105,018
West Punjab	304	337	224	23,728	21,405

Our analysis has found that container coverage for waste management is insufficient in Central and South Punjab, While Northern and Western Punjab have relatively higher coverage compared to their population share. West Punjab has the highest container coverage overall.

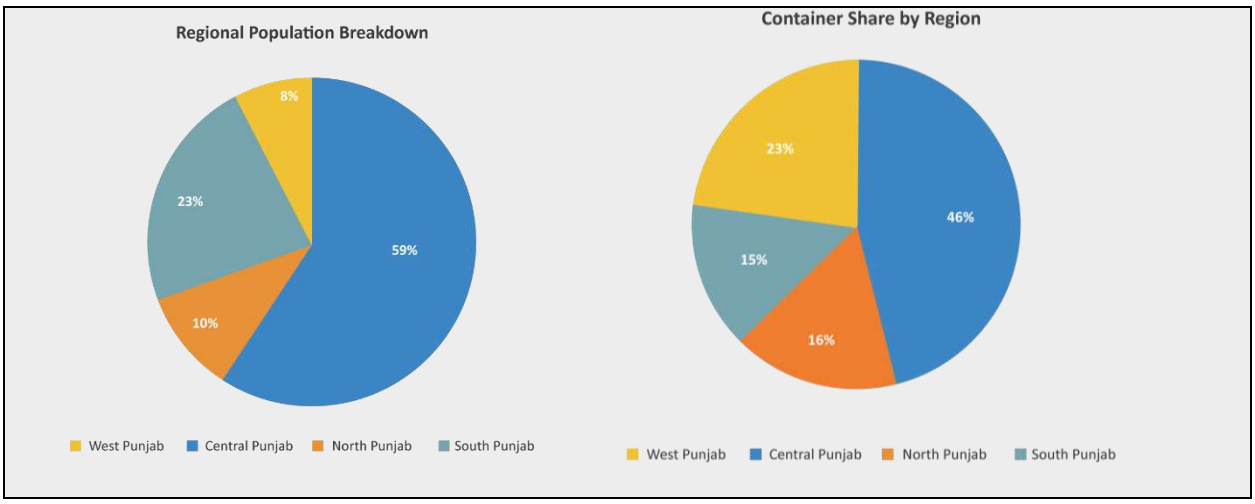

Figure 4 Source: Population Census (Bureau of Statistics, GoP) 2017 Source: Govt of Punjab – 2022

Despite some progress in container coverage for waste management in Punjab is still inadequate, serving an average of around 60,000 people per container Even in West Punjab, which has the best coverage, each container serves a population of 21,000 which is 14 times the number of people that should ideally be served based on an average waste of 0.5 kg/person-day. In South Punjab, where coverage is105,000 people per container, this equates to 70 times the population per container.

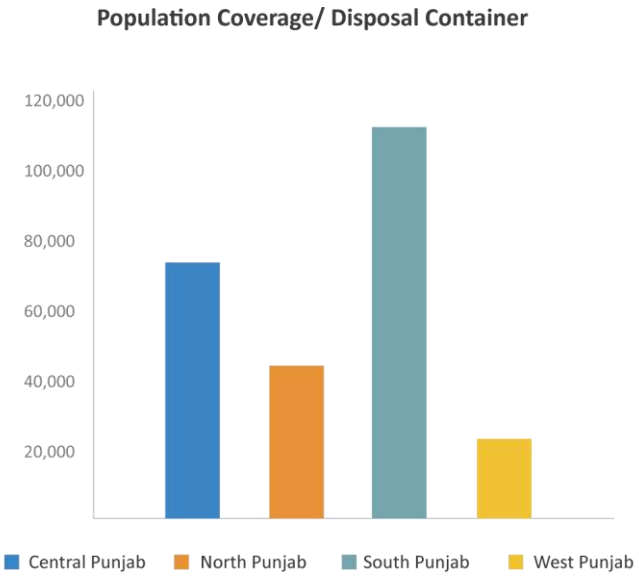

Figure 5 Source Govt of Punjab - 2022

Based on coverage, the districts with the best waste management practices are located in West and Central Punjab, with hang and Mianwali in West Punjab taking two top spots. The bottom 5 districts, which have least effective waste management, are from South and Central Punjab, with Layyah, Sheikhupura, and Lodhran lacking any government provided garbage container facilities.

Top 5 by Container Coverage	
	Population/Container
Jhang	14,745
Mianwali	15,426
Nankana Sb	18,311
Sargodha	21,121
Gujrat	22,050
Bottom 5 by Container Coverage	
	Population/Container
Muzaffargarh	180,356
Sahiwal	251,301
Layyah	No Coverage
Sheikhupura	No Coverage
Lodhran	No Coverage
Avg	**110,752**
Median	**54,342**

Figure 6

Note: Metros Excluded
Source: Govt of Punjab estimates – 2022

In addition to container average, the provision for machinery for waste management is another important factor to consider. As the type and size of machinery can vary based on the needs of the community, assessing the population coverage by a unit of machinery can help to understand the waste management capacity for a district. This information can be used to identify areas where additional resources may be needed to improve waste management practices.

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Muzaffargarh	118	24	85	36,683	180,356
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Gujrat	140	125	342	19,688	22,050
Hafizabad	55	43	138	21,036	26,906
Narowal	63	13	81	27,104	131,352
Sialkot	171	69	116	22,777	56,448
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Central	1,973	680	3,007	28,712	67,869
North Punjab	203	240	284	49,294	41,694
South Punjab	704	214	485	31,923	105,018
West Punjab	304	337	224	23,728	21,405

District Nankana Sahib has the best coverage in terms of waste management machinery, with a machine serving a population of approximately 4,000 people. In contrast, the district of Sheikhupura has the worst coverage, with a machine serving 62,000 people. A broader analysis of waste management data shows that waste management is often a low priority on the policy agenda and the choices are often influenced by provincial or federal government concerns, e.g., in case of Nankana sb or the efforts of some local political leader at the provincial or local level.

Top 5 by Machine Coverage	
	Pop Served/Machine
Nankana Sb	3,108
Pakpattan	14,712
Kasur	16,771
Mianwali	18,586
Chiniot	19,552
Bottom 5 by Machine Coverage	
	Pop Served/Machine
Chakwal	37,387
Gujranwala	42,110
Bhawalnagar	45,086
Sahiwal	49, 275
Sheikhupura	62,909
Avg	**43,714**
Median	**26,368**

Figure 8

Source: Govt of Punjab estimates, 2022
Note: Metros not included

Case Study: **Waste Management**

Introduction:

Pakistan is a country with a rapidly growing population and urbanization rate. With this growth comes an increase in waste generation, which has led to challenges in managing and disposing of waste in a sustainable and environmentally responsible way.

One approach to addressing these challenges is to study successful models of waste management in other countries and adapt them to the local context. Turkey is a country that has made significant progress in addressing its waste management challenges in recent years. In this case study, we will examine Turkey's experience with waste management and consider how some of the strategies and practices used in Turkey could be adapted and implemented in Pakistan.

Turkey's waste management journey:

Turkey has faced a number of challenges in managing its waste, including a lack of infrastructure, inadequate funding, and a lack of awareness and understanding among the general public about the importance of waste management.

In the past, waste in Turkey was often simply dumped in landfills or burned, leading to environmental pollution and public health problems. However, in recent years, Turkey has made significant progress in addressing these issues and improving its waste management practices.

One key strategy has been the development of a comprehensive national waste management plan that outlines the country's goals and objectives for reducing waste and improving waste management. The plan includes targets for increasing recycling rates, reducing the amount of waste sent to landfills, and promoting the use of environmentally friendly waste disposal methods.

To achieve these goals, Turkey has implemented a number of initiatives, including:

- Building and upgrading waste treatment facilities: Turkey has invested in building and upgrading waste treatment facilities, including waste-to-energy plants and composting facilities. These facilities help to reduce the amount of waste sent to landfills and also generate energy and fertilizers from the waste.
- Promoting recycling: Turkey has implemented a number of initiatives to promote recycling, including setting up recycling bins in public places and implementing a packaging waste recovery and recycling system. These efforts have helped to increase recycling rates in the country.
- Educating the public: Turkey has also focused on educating the public about the importance of waste management and the benefits of recycling. This includes public awareness campaigns and educational programs in schools.

Lessons for Pakistan:

Pakistan can learn from Turkey's experience with waste management in a number of ways. Some potential strategies and practices that could be adapted and implemented in Pakistan include:

- Developing a comprehensive national waste management plan: Like Turkey, Pakistan could develop a national waste management plan that outlines the country's goals and objectives for reducing waste and improving waste management. This plan could include targets for increasing recycling rates, reducing the amount of waste sent to landfills, and promoting the use of environmentally friendly waste disposal methods.

- Building and upgrading waste treatment facilities: Pakistan could invest in building and upgrading waste treatment facilities, such as waste-to-energy plants and composting facilities, to reduce the amount of waste sent to landfills and generate energy and fertilizers from the waste.
- Promoting recycling: Pakistan could implement initiatives to promote recycling, such as setting up recycling bins in public places and implementing a packaging waste recovery and recycling system. These efforts could help to increase recycling rates in the country.
- Educating the public: Pakistan could also focus on educating the public about the importance of waste management and the benefits of recycling. This could include public awareness campaigns and educational programs in schools.

Overall, Turkey's experience with waste management offers valuable lessons for Pakistan as it works to address its own challenges in this area. By adopting and adapting some of the strategies and practices used in Turkey, Pakistan can make progress in improving its waste management practices and contributing to a more sustainable and environmentally responsible future.

Waste Disposal

Waste Disposal Stations

Waste Disposal Stations are another aspect of solid waste management in Punjab. However, the province does not have any purpose-built landfill sites for its districts. The size and number of waste disposal stations varies among cities, with larger cities having fewer but larger stations. and smaller cities having a greater number of smaller stations spread across the district. This diversity highlights the need for tailored waste management strategies that consider the unique needs and characteristics of different communities in Punjab.

Table 9: Waste Disposal Data

	Existing Disposal Station	Existing Disposal St p.c.
Vehari	41	70,782
Layyah	25	72,960
Rahim Yar Khan	63	76,314
Khushab	13	98,490
Lodhran	15	113,313
Khanewal	25	116,809
Bahawalpur	31	118,361
Jhang	23	119,245
Shiekhupura	28	123,572
Bahawalnagar	24	123,986

Sahiwal	19	132,264
Hafizabad	8	144,619
Muzaffargarh	28	154,591
DG Khan	18	159,591
Okara	19	160,043
Toba Tek Singh	13	168,577
Chiniot	8	171,082
Kasur	20	172,744
Nankana Sb	7	193,569
Sargodha	19	194,537
Multan	24	197,757
Rajanpur	10	199,604
Pakpattan	9	202,692
Gujrat	13	212,022
Bhakkar	7	235,407
Sialkot	16	243,434
Gujranwala	20	250,553
Narowal	5	341,515
Jhelum	3	407,468
Faisalabad	17	463,673
M.B. Din	3	531,346
Mianwali	2	771,301
Attock	1	1,886,378
Rawalpindi	2	2,701,190
Lahore	3	3,706,662
Chakwal	-	#DIV/0!

Regional disparities in waste disposal station coverage also exist in Punjab, with South Punjab having the highest number of disposal stations per capita, and the North Punjab having the worst coverage.

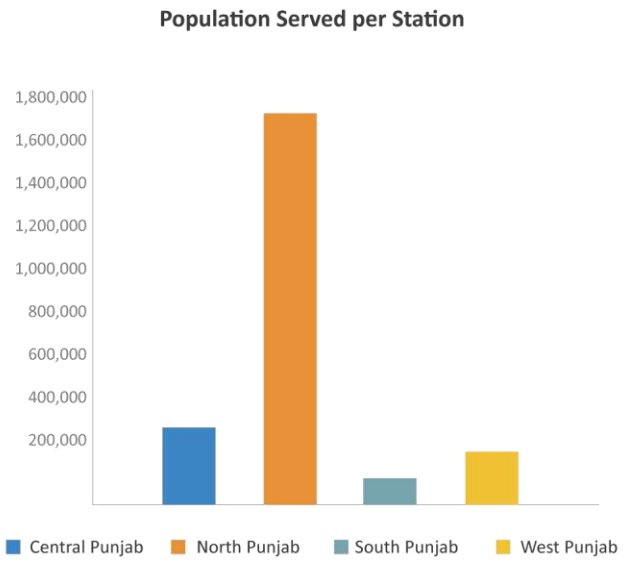

Figure 9: Govt of Punjab 2022

South Punjab has 42% of the province's waste disposal stations, despite only representing 23% of the population. In contrast, North Punjab has just 1% of total disposal stations, despite having a population of 10%.

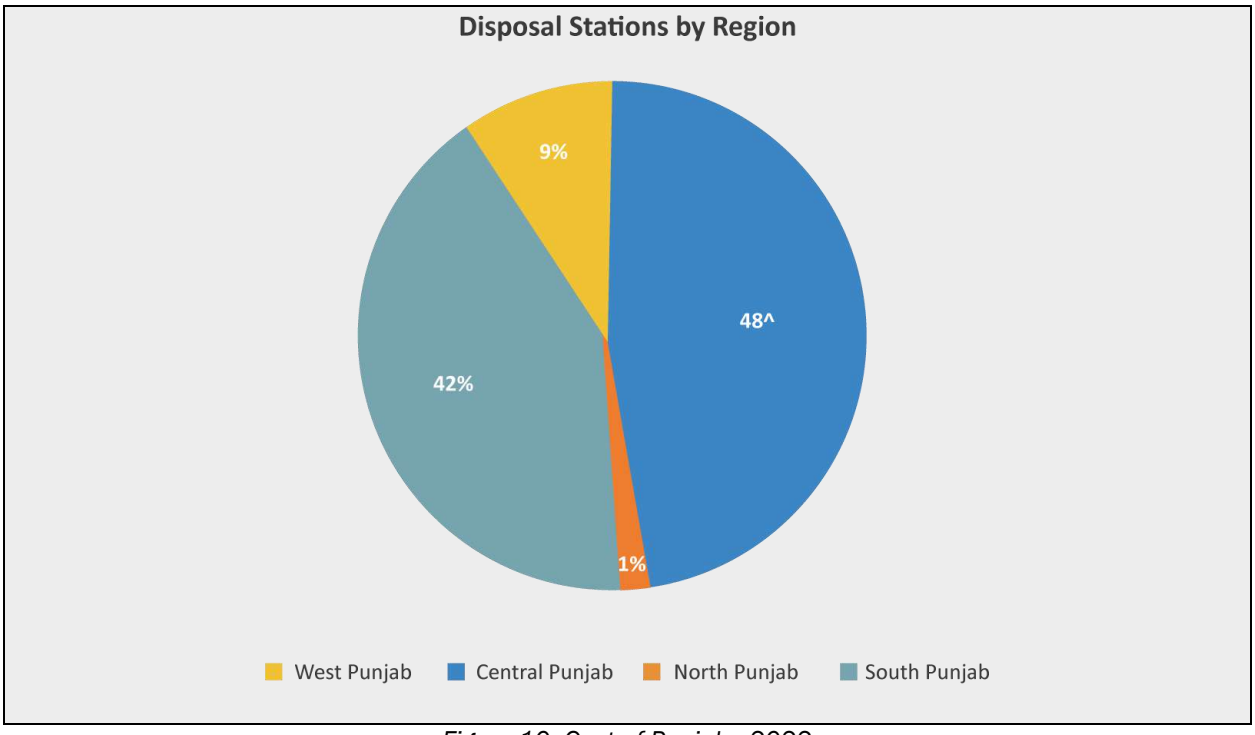

Figure 10: Govt of Punjab - 2022

Table 10: Disposal Station Coverage - Regional		
	Stations	Population Served per Station
Central Punjab	227	255,628
North Punjab	6	1,667,771
South Punjab	199	112,934
West Punjab	45	160,299

Excluding the metro cities, 4 out of the 5 districts with the best coverage of waste disposal stations (per capita) are located in South Punjab. On the other hand, the worst performing districts, with the least coverage, have 3 out of 5 districts located in North Punjab. Chakwal is the only district with no disposal stations.

Top 5 by Disposal Station Coverage	
	Population Covered/Station
Vehari	70, 782
Layyah	72,960
Rahim Yar Khan	76, 314
Khushab	98,490
Lodhran	113,313
Bottom 5 by Disposal Station Coverage	
	Population Covered/Station
Jhelum	407,468
M. B. Din	531,346
Mianwali	771,301
Attock	1,886,378
Chakwal	No Coverage

Figure 11 Source: Govt of Punjab estimates, 2022

Case Study: Dhaka, Bangladesh

Pakistan, like many developing countries, faces significant challenges in providing access to safe and reliable water and sanitation services for its rapidly urbanizing population. According to data from the World Health Organization (WHO), approximately 66% of the population in Pakistan has access to improved drinking water sources, and only 38% have access to improved sanitation facilities. This lack of access to clean water and proper sanitation has serious consequences for public health, as it can lead to the spread of waterborne diseases and other illnesses.

One city that has faced similar challenges in the past and has made significant progress in addressing them is Dhaka, the capital and largest city of Bangladesh. With a population of over 20 million people, Dhaka is one of the most densely populated cities in the world. It is

also a rapidly urbanizing city, with many people moving from rural areas in search of economic opportunity. This rapid urbanization has put a strain on the city's water and sanitation infrastructure, making it difficult to meet the needs of the growing population.

In the past, Dhaka's water and sanitation services were poorly managed and inefficient, leading to low levels of service quality and customer satisfaction. However, in the 1990s, the government of Bangladesh implemented a number of reforms to turn around the city's urban water services. These reforms included the establishment of a new water and sanitation utility, the Dhaka Water Supply and Sewerage Authority (DWASA), to manage the city's water and sanitation services.

The government also implemented a number of other measures to improve the efficiency and effectiveness of the city's water and sanitation services. These included the expansion of water treatment and distribution systems, the introduction of water conservation measures, and the promotion of proper sanitation practices. In addition, the government worked to increase transparency and accountability in the sector by establishing a regulatory framework and introducing performance-based contracts with private sector operators.

The reforms implemented by the government of Bangladesh have had a significant impact on improving water and sanitation services in Dhaka. According to data from the World Bank, the percentage of the population with access to improved drinking water sources in Bangladesh increased from 50% in 1990 to 95% in 2015. The percentage with access to improved sanitation facilities also increased from 38% in 1990 to 71% in 2015. These improvements have had a number of positive impacts, including improved public health, reduced environmental degradation, and economic development.

Pakistan could potentially benefit from studying and implementing similar reforms in its own cities to address its water and sanitation challenges. By establishing a strong and efficient water and sanitation utility, expanding infrastructure, and implementing regulatory and policy measures, Pakistan may be able to improve the quality and reliability of its water and sanitation services and improve the lives of its citizens.

Urban vs Rural

According to the 2017 Population Census, Punjab has a population of 110 million, out of which 69.4 million (63%) classified as rural, with remaining 40.6 million (37%) classified as urban. The census recognizes 260 agglomerations in Punjab as urban, while all other population centers, regardless of their size, density, or built environment, are classified as rural. The demarcation of new local governments under the now defunct PLGA (Punjab Local Government Act), 2019 classified approximately 309 populations centers as urban local governments.

Table 11: Comparison of Local Government Systems Classification				
	PLGA 2013	PLGA 2019	PLGA 2022-I	PLGA 2022-II
Metropolitan Corporation	1	9	9	11
Town Councils	0	0	27	0
Municipal Corporations	11	16	17	0
Municipal Committees	182	134	234	0
Town Committees	0	160	0	0
District Councils	35	0	35	35
Tehsil Councils	0	136	137	0
Total	229	455	459	46

The classification of an agglomeration as urban or rural significantly impacts the type and quantity of municipal services it receives. Urban centers in Punjab have larger local government establishments and mandates compared to the rural areas due to the way local governments were established in the 19th century during the British Raj in South Asia. At that time municipal services were recognized as the responsibility of urban local governments, but the same services were not recognized in rural areas. This discrepancy has persisted in subsequent local government systems introduced in Pakistan since 1947. While the Punjab Local Government Act-2019 and the Punjab Local Government Act-2022 have attempted to address this issue, their impact at the local level has been limited.

On the flip side the disparity in service provision between urban and rural areas in Punjab is also reflected in the taxation and funding for municipal services. While urban residents pay a property tax known as the Urban Immovable Property Tax (UITP) to their local governments, which is than collected by the provincial government and distributed to the local governments after a collection surcharge is deducted by the provincial government. Property tax is significantly under-utilized in Punjab, accounting for only 6% of the total provincial tax. In fact, all of Punjab collects less urban property tax than the city of Chennai, which has a population about 10 million people, despite having a population of over 100 million.[5]

While urban areas and cities in Punjab do not fare particularly well in terms of service provisioning, rural areas are in even worse shape, with a significant lack of access to essential municipal services.

[5]Wani, S., Shaikh, H., and Harman, O. (2020) 'Urban Property Taxes in Pakistan's Punjab,' International Growth Centre (IGC).

According to an IGC policy brief on Punjab's property taxes;

- 4 in 10 urban households in Punjab don't have access to toilets connected to sewer systems;
- Only 35% of urban households in Punjab have piped water;
- 10% of urban households don't have access to handwashing facilities with water and soap.
- Punjab's urban housing deficit is estimated at 6.4 million housing units.
- This is primarily due to underfunding of services due to an outdated property tax regime.

Property taxes are an important source of revenue for local governments around the world, helping to finance the delivery of critical public services. In the United States, about17% of state and local revenue comes from property taxes, which fund services such as schools, roads, and police departments. In the United Kingdom, local councils rely heavily on property taxes to finance their services. Across the OECD countries, property taxes are equivalent to about 2% of GDP while in emerging markets it is about 0.6% and in low-income countries it is 0.3% of GDP. However, in Pakistan, property tax collection is less than 0.1% of GDP.

With the implementation of new decentralization laws in Punjab, which came into effect in April 2019 (PLGA, 2019), June 2022 (PLGA, 2022) and November, 2022 (PLGA, 2022-II), the importance of property taxes has increased as the laws create new local governments with broader responsibilities for delivering critical public services in both urban and rural areas. This presents an opportunity to strengthen Punjab's property tax infrastructure for cities and explore ways to fund services in rural areas. PLGO, 2001 aimed to bridge this gap through the formation of Tehsil Municipal Administration but PLGO, 2001 was scrapped before municipal service provisioning could be institutionalized across the rural-urban divide.

Legislative History and Mandates

Table 12: Functions of Local Governments under Punjab Local Government Act-2013

Local Governments	Metropolitan Corporation	Municipal Corporation	Municipal Committee	Town Committee	District Council
Type	Urban	Urban	Urban	Urban	Rural
Waste Management	✅	✅	✅	✅	❌[1]
Water Supply	✅	✅	✅	✅	❌
Water Filtration	✅	✅	✅	✅	❌

Plants					
Sewerage / Sewage	✅	✅	✅	✅	❌

1. *Function granted to District Councils via Amendment in PLGA, 2013 and under subsequent legislative frameworks; however, no waste management systems created to date.*

Table 13: Functions of Local Governments under Punjab Local Government Act-2022-II

Local Governments	Metropolitan Corporations	District Council
Type	Urban	Rural& Urban[1]
Waste Management	✅	✅
Water Supply	✅	✅
Water Filtration Plants	✅	✅
Sewerage / Sewage	✅	✅

1. *All cities except 11 Metropolitan Corporations have been merged with 35 District Councils as a unitary local government for the entire district.*

Assessing the Current Capacity for Waste Management in Punjab

Waste Management Companies

Introduction

Punjab established eight (8) waste management companies to cover the entire province.

- Lahore Waste Management Company
- Faisalabad Waste Management Company
- Gujranwala Waste Management Company
- Sialkot Waste Management Company
- Rawalpindi Waste Management Company
- Multan Waste Management Company
- Bahawalpur Waste Management Company
- Dera Ghazi Khan Waste Management Company

Most of the waste management companies operating in Punjab are based in divisional headquarters and serve the urban areas of these regions. Sahiwal, Sargodha, and Gujrat are the only divisional headquarters without their own waste management company, and the waste management in these cities are instead carried out by municipal corporations or their respective local governments.

Following are the incorporation years of the WMCs:

WMC	Inception
LWMC	2012
RWMC	2014
GWMC	2014
SWMC	2014
BWMC	2013
FWMC	2013
MWMC	2013
DGKWMC	2020

Figure 12 Source: Govt of Punjab – 2022

Performance Comparison

Evaluating the performance of Waste Management Companies (WMCs) can be challenging. However, one measure that can provide insight into the efficiency of these companies is cost per ton of waste removed. The measure indicates the operational efficiency of various WMCs. Factors such as population density, speed of waste removal may also impact this measure. Based on the available data, most WMCs have removal costs in the PKR 3000-4000/ton

range. Bahawalpur Waste Management Company is the most efficient operator, with a cost of PKR 2900/ton. This was maybe due to higher CAPEX spending and higher funding per capita which is reflected in the company's performance. (Discussed below).

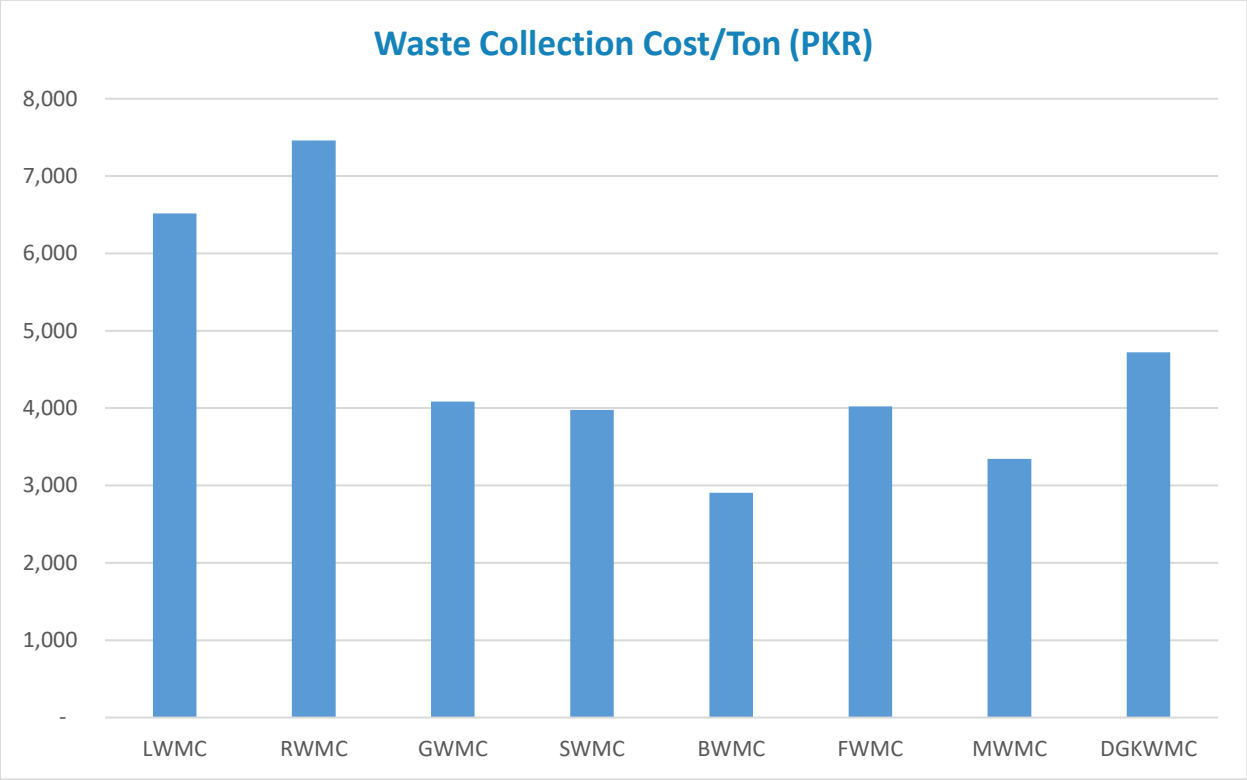

Figure 13 Source: Govt of Punjab – 2022

The Lahore and Rawalpindi Waste Management Companies standout based on their per ton collection cost which are 2-3.5 times higher than average. This may be due to the efficiency of their operations, as Lahore and Rawalpindi are more modernized cities in Punjab. DG Khan Waste Management Company is relatively new, and it is likely that operational costs will improve with extended operations. Overall, it is important to consider the specific challenges and opportunities facing different waste management companies in order to effectively evaluate and improve their performance.

The staffing of sanitary workers is another factor to consider when comparing the performance of waste management companies. Almost all WMCs have one sanitary worker for around 1000 people. The exception is the Sialkot Waste Management Company, which has a ratio of one sanitary worker per 8000 people. Ensuring adequate staffing levels and resources for waste management personnel is essential for effective and efficient waste management practices.

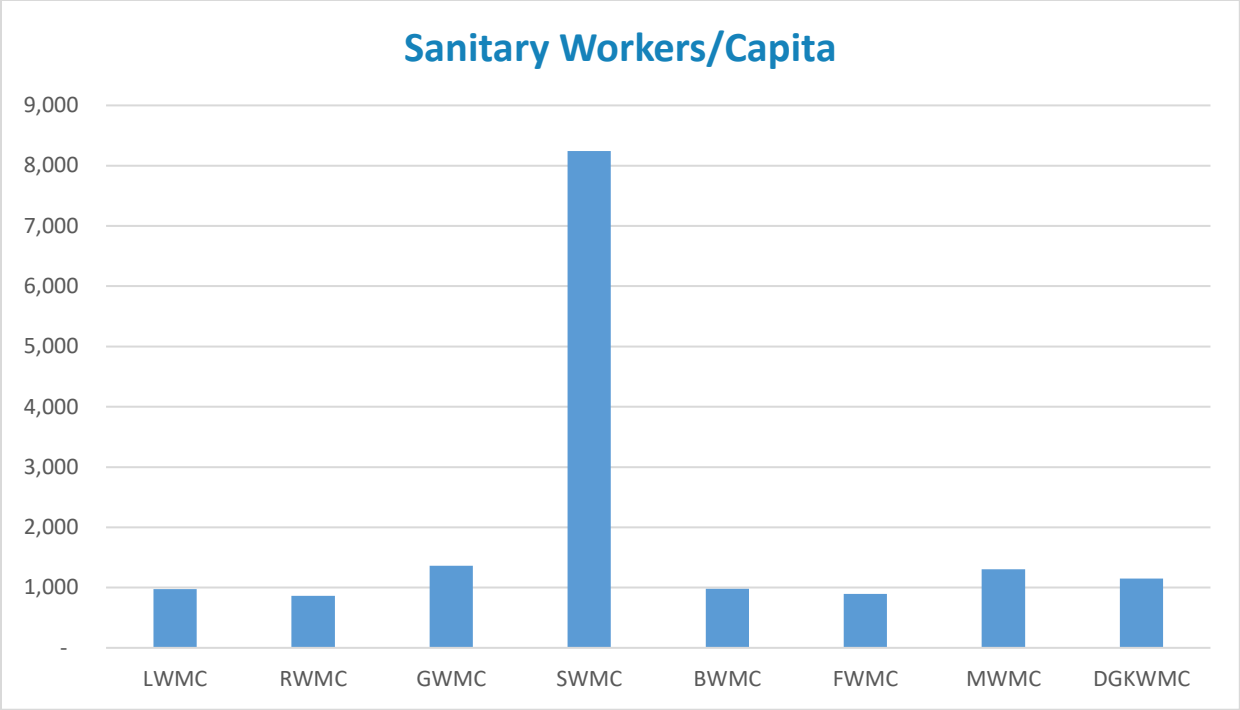

Figure 14 Source: Govt of Punjab 2022

This chart needs to be understood along with %age waste collected to assess the effectiveness of worker deployment

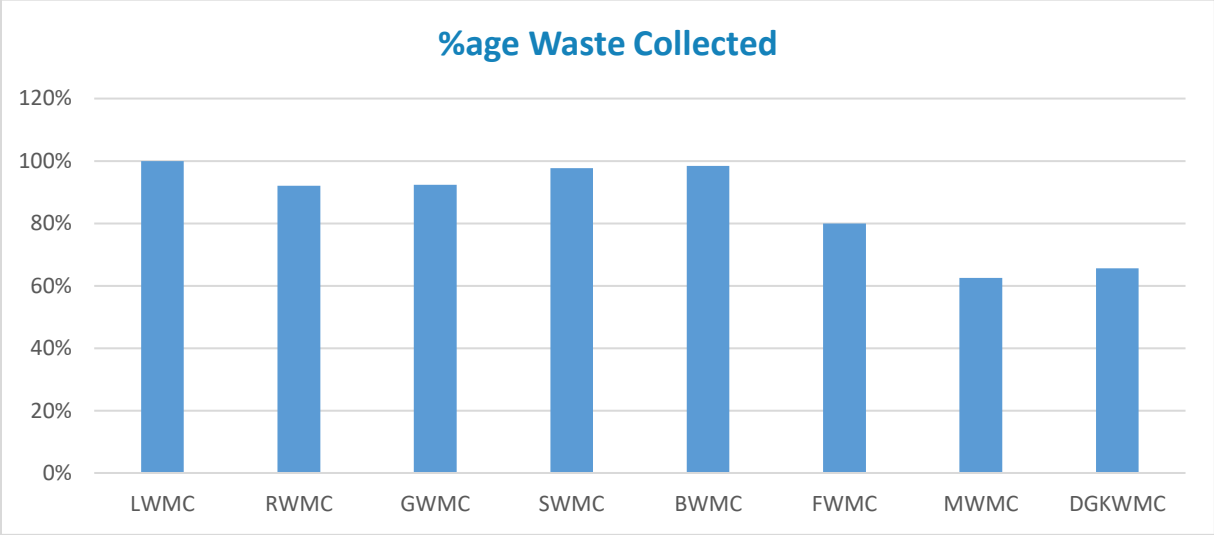

Figure 15 Source: Govt of Punjab - 2022

Comparing the staffing and cost per ton of waste removed matrices reveals some notable differences between waste management companies. Lahore and Bahawalpur stand out for their staff productivity, while D. G. Khan and Multan lag behind. The most impressive

performance comes from the Sialkot Waste Management Company, which has a similar level of waste collection with eight (8) fewer staff per capita.

To understand resource allocation for waste management in different cities, it is useful to examine total spending per capita. This can include both loans and government grants. To get a better picture of funding over time, it is helpful to consider per capita funding (including both loans and grants) per year. This measure allows for comparison between waste management companies that were incorporated at different times.

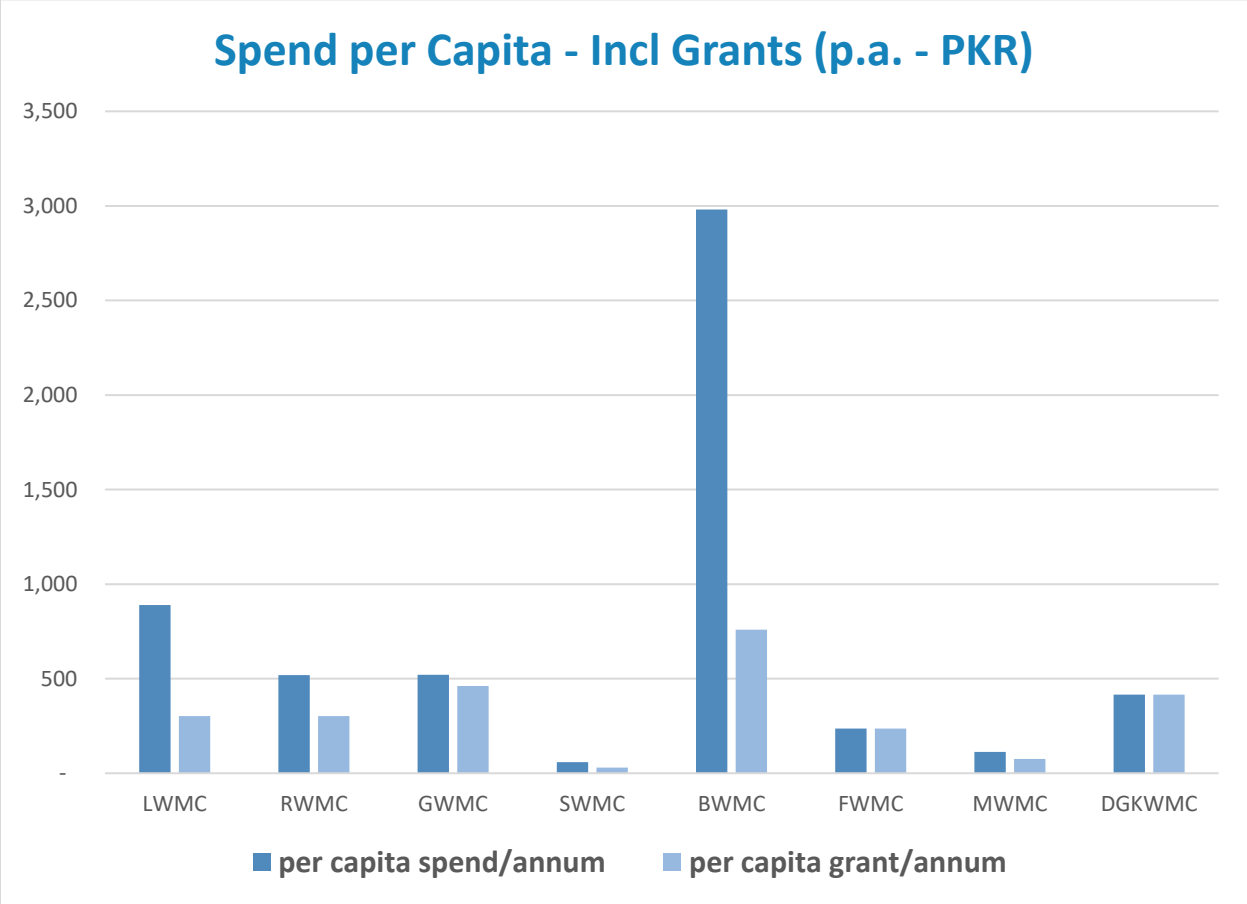

Figure 16 Source: Govt of Punjab – 2022

Table 13

Waste Management Companies - Spend and Operations Data

WMC	Inception	Y	Population Served	Daily Waste Generated	Daily Waste Lifted	%age waste collected	per capita waste (daily - kg)	Grant (mil)	Loan (mil)	Total Spend (mil)	per capita spend/annum	per capita grant /annum	Sanitary Workers Deployed	Sanitary Workers/Capita	Spend/Sanitary Worker	Spend 2021 (mil)	Cost/Ton
LWMC	2012	10	11,130,000	6,000	6,000	100%	0.54	33,678	65,331	99,010	890	303	11,401	976	868,431	12,357	6,516
RWMC	2014	8	2,016,981	950	875	92%	0.43	4,865	3,509	8,375	519	302	2,343	861	446,794	2,436	7,460
GWMC	2014	8	2,665,000	1,194	1,103	92%	0.41	9,837	1,264	11,101	521	461	1,956	1,362	709,413	1,244	4,085
SWMC	2014	8	7,032,940	440	430	98%	0.06	1,646	1,650	3,295	59	29	853	8,245	482,924	610	3,979
BWMC	2013	9	681,736	325	320	98%	0.47	4,658	13,632	18,290	2,981	759	695	981	2,924,014	373	2,905
FWMC	2013	9	3,210,158	1,600	1,280	80%	0.40	6,828	-	6,828	236	236	3,595	893	211,038	1,657	4,022
MWMC	2013	9	2,569,683	1,200	750	63%	0.29	1,766	839	2,605	113	76	1,973	1,302	146,714	928	3,345
DGKWMC	2020	2	434,988	320	210	66%	0.48	362	-	362	416	416	378	1,151	478,836	325	4,722

In terms of loans and government grants, Bahawalpur is the most funded district (on a per capita basis). Sialkot on the other hand, receives the least per capita funding and grants, yet remains efficient in terms of waste collection. It's worth noting that Bahawalpur, Lahore, and Rawalpindi Waste Management Companies have financed a large portion of their operations through loans in addition to their PFC allocation; this points towards a broken municipal finance regime especially reforming urban immovable property tax (UIPT) in the province. Despite being well funded, Rawalpindi and Gujranwala do not show similar level of efficiency in their waste collection operations.

Climate Change and Nationally Determined Contributions

Pakistanis facing significant challenges in its waste, including a lack of infrastructure for collection, transportation, and treatment, as well as limited public awareness and understanding of proper waste management practices. As a result, much of the country's waste is either improperly disposed of in landfills or left uncollected, leading to environmental degradation, public health issues, and GHG emissions. According to the Ministry of Climate Change, the country's total GHG emissions in 2018 were around 456 million metric tons. This includes emissions from the energy, industrial, agriculture, and waste sectors.

Out of which according to the estimates provided by Ministry of Climate Change, the country's waste sector is responsible for approximately 2% of total GHG emissions, with the majority of emissions coming from the decomposition of organic waste in landfills. The waste sector also contributes to other environmental problems, such as air pollution, water pollution, and soil contamination. Pakistan also submitted these estimates in its Nationally Determined Contributions (NDC) to the United Nations Framework Convention on Climate Change (UNFCCC) as part of its commitment to the Paris Agreement. In this document, Pakistan has also outlined its commitments and actions to address climate change and reduce greenhouse gas (GHG) emissions.

According to Pakistan's NDC, the country aims to reduce GHG emissions by 20% by 2025, compared to a business-as-usual scenario. But it will largely to address these issues, Pakistan urgently needs a comprehensive waste management strategy that includes measure to reduce the amount of waste generated, improve the collection and transportation of waste, and increase the use of environmentally-friendly waste treatment technologies. This could include initiatives to promote waste segregation and recycling, as well as the development of waste to energy facilities to generate electricity from waste.

In addition to these measures, it is also important for Pakistan to improve the accuracy of its GHG emission estimates for the waste sector, as this will allow policymakers to better understand the magnitude of the problem and devise effective solutions. This could involve conducting more comprehensive studies on the sources and quantities of waste in the country, as well as implementing monitoring and reporting systems to track progress on waste management efforts.

Overall, addressing the challenges of waste management in Pakistan will require a multi-faceted approach that involves the efforts of various stakeholders, including the government, private-sector, civil society, and international organizations. By working together to implement effective waste management policies and practices, Pakistan can make significant progress in reducing GHG emissions, protecting environment, and improving the health and well-being of its people.

Recommendations

- **Improving Data Reliability for Waste Management Planning**
  The reliability of government data, on waste generation is a major concern for effective planning. To address this issue, studies should be conducted to align data collection and documentation with regional best practices. One contributing factor to poor data quality is the centralization of data management in provincial bureaucracies, with no effective mechanisms for local government level data collection and updating at the Union Council level. Improving data reliability is crucial for informed decision-making and successful waste management initiatives.

- **Standardizing Waste Disposal Practices**
  Currently there are no defined standards for waste disposal in many cases, leading to the use of inadequate “landfills" that are simply disposal sites. To address this issue, standardization of landfill facilities and, benchmarking of areas for compulsory landfill availability based on population are needed. Additionally, mechanism to monitor compliance with these standards is necessary to ensure proper waste disposal practices. Implementing these measures will help to improve the overall waste management system and protect the environment.

- **Addressing Waste Water Drainage and Pollution**
  Waste water drainage is currently not a priority in policy discussions. As a result, sewerage water is being dumped in rivers and streams, polluting the natural water sources. Even in rural areas, open sewerage systems often contaminate localized pools and can permeate into groundwater sources, leading to widespread water pollution. Addressing this issue through improved waste water management policies and infrastructure is crucial for public health and environment.

- **Using GIS Mapping for Sewerage Coverage Assessment**
  To accurately assess of sewerage coverage and plan for future needs, GIS maps for all cities, towns and districts of Punjab should be developed for the province showing the type and extent of coverage, as well as. population density information. These maps will enable data-driven decision-making and targeted planning of sewerage schemes, improving the efficiency and effectiveness of waste management initiatives.

- **Mapping and Planning for Water Filtration Plants**
  GIS mapping should be used to identify locations for water filtration plants, ensuring that they are placed in areas where they will have maximum impact and resource

utilization. The installation of these plants should not be solely driven by political considerations, but rather should be based on data-driven decision-making to optimize their effectiveness and efficiency

- **Political Factors Impacting Waste Management Coverage and Efficiency**
  Political considerations often play a significant role in determining the coverage and efficiency of water filtration, sewerage, and waste disposal systems. In some cases, these initiatives are used as a means to appeal to voters, while in others, the elected representatives may seek to prioritize development in their own districts. However, the lack of merit-based criteria for these schemes leads to disparities between districts and inefficient resource allocation. To address this issue, it is important to establish quantifiable criteria and remove political influences from decision-making processes in these areas.

- **Funding and Maintenance Issues in Centralized Waste Management Schemes**
  One issue with waste management schemes in the Government of Punjab is that they are often centralized, leading to maintenance and upkeep challenges for local governments. To address this issue, the Provincial Finance Commission should allocate funds for all areas that fall within their domain or are on the provincial concurrent list (where responsibility lies with both the provincial and local government, e.g., education). This will ensure that local governments have the necessary resources to maintain and manage infrastructure in these areas.

- **Climate Change and Water Management in Punjab**
  Waste management, water supply, and sewerage w are interconnected with climate change in a two-way relationship. There is currently no evidence of climate impact assessment being considered in government infrastructure planning at the local level, despite the fact that water tables in the Punjab are declining and water scarcity is a growing concern. To address this issue studies should be conducted to allocate water quotas for various sectors, including residential, commercial, industrial, and agricultural use. These quotas should be based on water availability forecasting have mechanisms for amendment at provincial districts level through consensus. The Punjab Aab-e-Pak Authority Act 2019 established the Punjab Aab-e-Pak Authority to oversee the provision of clean drinking water and the development of water resources, including through the implementation of water quotas and conservation measures. To further improve the effectiveness of the Punjab Aab-e-Pak Authority, some potential strategies could include:
  i) Increasing public awareness and education about the importance of clean drinking water and water conservation.

ii) Providing technical assistance and support to local governments and communities to help them implement water quotas and conservation measures.
iii) Establishing partnerships with private sector organizations and NGOs to leverage their expertise and resources for water management initiatives.
iv) Investing in research and development to identify new technologies and approaches for improving water efficiency and availability.
v) Collaborating with other agencies and stakeholders to coordinate and align efforts towards common goals for water management in the province.
vi) Regularly monitoring and evaluating the effectiveness of water management policies and programs, and making necessary adjustments based on data and feedback.

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Centre for Peace and Development Initiatives (CPDI) is an independent, non-partisan and a not-for-profit civil society organization working on issues of peace and development in Pakistan. It is registered under section 42 of the Companies Ordinance, 1984 (XLVII of 1984) latter substituted by Companies Act 2017. It was established in September 2003 by a group of concerned citizens who realized that there was a need to approach the issues of peace and development in an integrated manner. CPDI is a first initiative of its kind in Pakistan. It seeks to inform and influence public policies and civil society initiatives through research-based advocacy and capacity building in order to promote citizenship, build peace and achieve inclusive and sustainable development. Areas of special sectoral focus include promotion of peace and tolerance, rule of law, transparency and access to information, budget watch, media watch, local government, climate change, election watch and legislative watch and development.

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