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WASTE MANAGEMENT
THE CASE OF CITY OF TEHRAN
IN IRAN

FLANDERS INVESTMENT & TRADE MARKET SURVEY

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WASTE MANAGEMENT IN IRAN - THE CASE OF CITY OF TEHRAN

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CONTENT

1. INTRODUCTION

Efficient municipal waste handling is a key prerequisite for building sustainable cities and communities with responsible consumption and production. The world, today, generates 2.1 billion tons of municipal solid waste which is expected to reach 3.40 billion more than double the population growth by 2050, according to the World Bank. The share of each person per day is on average 740 gram that could range from 110 gr to 4.54 Kg. One of the fastest growing regions of the world is the Middle East and North Africa, where by 2050, total waste generation will be more than double. A significant portion of the waste in this region is currently openly dumped with serious implications for the environment and public health which makes it an urgent issue to tackle.

As a populous developing country in the Middle East, Iran offers enormous untapped potential in waste management and recycling industries. The country produces 21 million tons of solid waste per year of which modest volumes of 5% to 10% is effectively recycled. Growing environmental challenges related to dumping of waste such as leachates and greenhouse emissions among others require investment, modern solutions & technology to ensure urban sustainability in the long run. The country's diverse geographical landscape and therefore, differing needs offers a wide range of opportunities for cooperation with the foreign companies.

In this report, the situation of municipal solid waste management in Iran in general and the city of Tehran in particular, has been reviewed in order to shed more light on the current state of affairs and identify overall challenges and potential opportunities. The focus of the present report is on municipal solid waste management which refers to the amount of waste collected by or on behalf of municipal authorities and disposed of through the waste management system.

2. COUNTRY OVERVIEW

Iran is located in the western Asia with a surface area of over 1.6 km2 making it the second largest country in the region and 17th in the world. According to the US Energy Information Administration (EIA), Iran ranks respectively 3rd & 2nd in the world in terms of oil and natural gas reserves. In the Middle East, Iran holds 24% of the oil reserves and 12% of the world. In 2021, the country ranked 5th among OPEC oil producers and was the 3rd largest natural gas producer in the world.

As an emerging market and developing economy, the real GDP growth in Iran in 2022 is predicted at 3%, according to the recent outlook published by the International Monetary Fund. Inflation & unemployment rate in the country for the same period is expected to be 45%. & 9.4% respectively. It should be noted that Iran's economy is mainly driven by oil sector and services. Water and energy shortages have led to contraction of agriculture and industry sectors in 2021-2022.

Based on the latest local statistics, Iran has a population of over 84 million (2020) of which over 63 million (about 77%) live in the cities and 21 million in rural areas. The country is divided into 31 provinces and 469 large cities with Tehran (9m), Mashhad (3m) and Isfahan (2m) being the most populated in 2020.

Effective waste management for such a big population with estimated annual urbanization rate of 1.32% for 2020-25 is one of the key challenges that the government faces. Special efforts have been made to modernize the waste management systems and significant progress has been made in deploying various methods. There are, however, challenges to be tackled and potentials to be realized which the report aims to identify.

3. NATIONAL LEGAL FRAMEWORK FOR WASTE MANAGEMENT

Article 50 of the Constitution of the Islamic Republic of Iran (1979) specifically stipulates the necessity for preserving the environment and considers it a "public duty". Economic and any other activities that pollute or damage the environment are forbidden and in the Penal Code of the country specific penalties have been envisaged.

At macro level, Waste Management Legislation (2004) and its by-laws (2005) set the framework for waste management at national level. Based on the Legislation, Department of

Environment (DoE), Ministry of Interior, municipalities together with the National Working Group on Waste Management are the key regulators, supervisors and executers in the field.

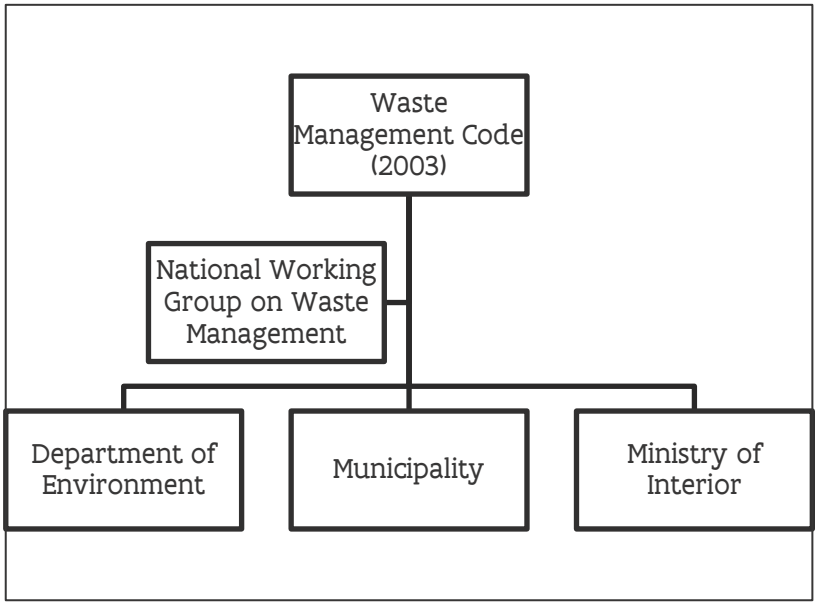
National Working Group on Waste Management is composed of the head of DoE (as the Chair), deputies from ministries of interior, health, industry, Petroleum, Energy, Agriculture and Standard & Industrial Research as well as I.R. of Iran Broadcasting, Budget & Planning Organization and Deputy Mayor of Tehran. The working Group is created to promote inter-agency coordination on matters related to drafting, regulating and reviewing waste types, recycling and proposing regulations and guidelines.

The Legislation appoints the DoE of Iran as the top body supervising the implementation of the provisions of the Waste Management Legislation and its executive by-laws. Head of DoE is also the Vice-President that brings the agency to the ministerial level. DoE is also responsible for waste management standard setting in many areas. International conventions such as Basel, Rotterdam, Minamata and Stockholm to which Iran is a party serve as the backbone of the local environmental laws.

Article 1 of the Waste Management Legislation (2004) obliges all natural and legal entities to observe the regulations governing the waste management. It identifies five main groups of wastes as normal (urban & rural) agricultural, medical, industrial and special waste. The Legislation is currently under modification in the relevant committees in the Parliament.

The Ministry of Interior is also one of the bodies responsible for developing executive instructions and guidelines for waste management. The Organization for Municipalities and Rural Districts affiliated to the ministry follows up the implementation of comprehensive operational plans for municipal waste management through local municipalities and rural authorities across the country. Therefore, at micro level, local municipalities through waste management organizations within their structures are responsible for waste management operations from collection, storage, separation, transportation, recycling, processing/pre-treatment to the disposal of waste as well as public training and awareness raising.

Waste Management Legal Structure in Iran



(source: Center for Governance & Society Empowerment,2020)

4. SOLID WASTE GENERATION & MANAGEMENT IN IRAN: OVERVIEW & STRUCTURE

Based on the latest available local statistics by the Ministry of Interior, daily waste generation in urban and rural areas of Iran is respectively 45k tons and 10k tons. Waste generated per person per day in urban and rural areas of Iran is also respectively 760gr and 485gr.

Of the total waste generated in the country, 65% is organic of which 60% can be converted into compost or energy. Around %35 of the total waste is dry which, if recycled, can produce high economic value. However, only around 25% of the total generated waste is processed/pre-treated and the remaining 75% is disposed in landfills mostly located around cities, villages, forests or even seas with serious environmental implications, polluting air, underground and surface water resources. The toxins and dangerous leachates of the waste containing all kinds of chemical and biological hazardous substances, have caused irreparable damages to the country's water and soil resources. Unfortunately, no study has been carried out on the extent of the damage caused by waste mishandling but experts estimate the damage to be far beyond imagination. It should be noted that only 10% of the total waste is segregated at source.

Reducing the number of landfills/waste burial sites around the country has been one of the priorities of the government. In the period 2013 – 2020, the number of landfills has been reduced to 660 from 3,300 and efforts are underway to further reduce the number. Eventually, the government hopes to eradicate landfills but to achieve this, considerable investments in waste management is required to upgrade technical and engineering infrastructure which is not an easy task given the US sanctions.

For the moment, Iran is still in the early stages of producing electricity from waste. As mentioned earlier, organic waste accounts for over 65% of the total municipal solid waste in the country which is opposite the global trend. Only two incinerators in Iran namely in Tehran and Noshahr (a city in the North of Iran) can convert waste to electricity. The capacity for each incinerator is 200 tons per day that can produce 3 MW electricity. Other incinerators such as the ones in the city of Sari (450 ton waste per day/7MW electricity) and Rasht (600 tons per day/9 MW) are yet to be operationalized. In 2021, the government passed a law to encourage private sector to assist in municipal waste management. The new decision is in early stages of execution.

Biomass Powerplants

According to Iran Renewable Energy & Electricity Productivity (SATBA), there are currently 7 biomass powerplants across the country with different technologies and electricity generation capacity of 14MW. These powerplants are not utilizing their full capacity given their technical, legal or economic problems. In June 2022, SATBA initiated a "Waste-To-Energy" initiative in order increase biomass plants in large cities, northern provinces and cities with population of over 100k. Based on the initiative, private investors and local municipalities co-invest (60%-40%) to build and install power plants under BOT contacts and SATPA guarantees the purchase the generated electricity on approved tariffs. The project is hoped to increase biomass plant capacity to 400MW, saving 850 million cubic meter of natural gas and creating 7000 employment opportunities across the country.

Plastic Waste Generation in Iran

Based on global statistics, Iran is among the top producers of Mismanaged Plastic Waste (MPW). MPW is the waste that evades proper disposal or recycling and instead ends up decaying on land or, more frequently, in the ocean. In 2021, Iran has produced 4.9 million tons of plastic waste of which 928 tons is released to marine environments, based on World Population Review. According to the Department of Environment of Iran, per capita consumption of plastic bags by Iranians is 3 per day with average lifetime of 12 minutes equal to half a million tons of waste of which 96% ends up in the garbage bin directly.

It is worthwhile to note that the energy required to produce 1.5 million tons of plastic bottles is equivalent to 47 million gallons of oil, not to mention the greenhouse emissions released in the process. Plastics last 500 to 700 years in the nature before being decomposed which also takes 1000 years in the case of resistant types. They pollute the soil and are harmful the environment.

In mid-October 2022, the Cabinet of Ministers passed a set of regulations aimed at reducing the use of single-use plastic bags in the country. Among other things, free-of-charge distribution of plastic bags except in grocery shops is banned. Moreover, free distribution of plastic bags with less than 25-micron thickness is forbidden. In chain stores, it is forbidden to use plastic bags thinner than 60 microns. Producers of plastic bags and other plastic goods such as gloves and tablecloth are required to increase the thickness of their products to over 25 microns so that they can be recycled and reused. The new regulations should be implemented within 3 months after official notification of relevant stakeholders.

5. MUNCIPAL SOLID WASTE GENERATION & MANAGEMENT IN THE CITY OF TEHRAN

Waste Generation in the city of Tehran

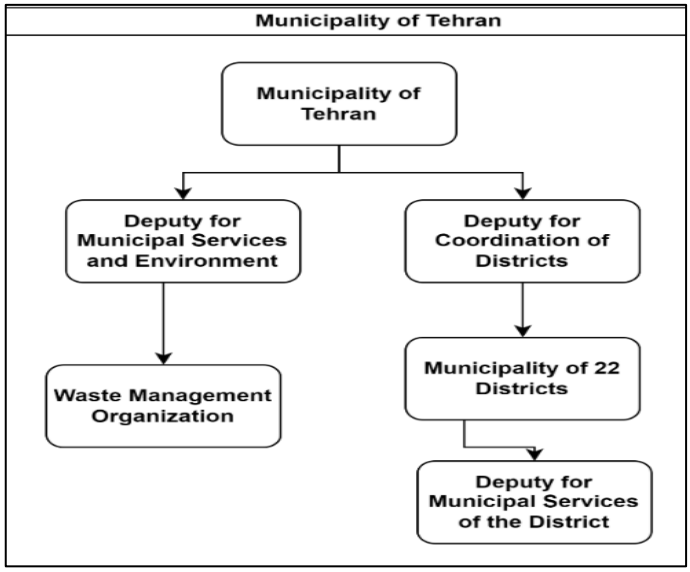
The city of Tehran is located in the province of Tehran in the north-center of the country. It is the capital city and at the same time the most populous one, home to over 9 million people in a surface area of 730 square kilometers divided into 22 municipal districts.

Statistics given by waste management and environment authorities vary slightly in the volumes of the normal solid waste generated in Tehran. The average however seems to be somewhere between 5,700 to 6,500 tons per day. In the period March 21, 2021 – March 20, 2022, over 2.3 million tons of waste was generated in Tehran, according to Tehran Waste Management Organization. The physical analysis of Tehran waste indicates that per capita per person per day figure for the city in 2019 and 2020 was 764 grams per day. World's average per capita waste production per person in 2020 was 790 gr per day, according to the World Bank.

While population, lifestyle, consumption patterns, as well as social, geographical, & technological factors contribute to the amount of generated waste, a recent study by the Iranian Parliament Research Center (July,2021) has underlined economic factors as the key cause in the changing volumes and composition of solid waste in the city of Tehran. Based on this study, concurrent with jumps in inflation in the years 2009, 2012, 2016 and 2020, waste

generation volumes in the city of Tehran dropped. During 2016-2020, total and per capita waste generation respectively fell by 26% and 11% in Tehran. In the same period, segregated dry wase fell by 65% with serious implications for the recycling industry. It should be, however, added that the decline in segregated dry waste is also partly due to the growing number of informal waste collectors across the city. Rising inflation (currently at 43%) together with local currency depreciation has changed the consumption patterns of households in Tehran. On par with shrinking purchasing power, Tehrani households have limited their purchases to basic food items which means more organic waste compared to dry leading to higher leachate and methane emissions from the main landfill in Tehran, Aradkouh, where around 55% of the generated waste is dumped. Moreover, social factors such as informal network of dry waste collectors as well as public awareness on environmental matters have impacted the volume and composition of waste in Tehran.

Waste Management Structure in Tehran



(source: Center for Governance & Society Empowerment,2020)

As mentioned earlier, based on the Waste Management Legislation (2004), waste management in the cities is the responsibility of municipalities. Municipalities should lay the necessary mechanized infrastructure for waste collection, segregation and recycling either through their own and governmental financial means or private investment. In practice, municipalities contract private companies for the task in each city district. Tehran Waste Organization (TWMO) is responsible for the waste management in the city of Tehran as far as normal waste

is concerned. Normal waste includes waste produced by households, construction sector, non-hazardous hospital waste or any other waste that has been treated to become non-hazardous and normal including industrial waste.

Of the total waste collected in the city of Tehran about 700-800 tons are segregated at source and over 5k tons is transferred to *Aradkouh Waste Management Center* (surface area of 1,364 hectare) where mixed processing/pre-treatment of organic and dry waste with the capacity of 7,500 tons is carried out. The processed/pre-treated waste is divided into three parts. The recycled materials are returned to the industrial cycle. Organic waste is converted to compost. About 200 tons of the waste (w/o economic value) is burnt in the only incinerator available at the center to produce 3 MW electricity. The remaining waste which is estimated to be 50% to 55% of the total waste entering the center is dumped on the site. Some media reports estimate that the height of the dumped waste at Aradkouh is around 60 meter and weighs around 9,000 tons.

Given the adverse environmental impacts of Aradkouh on the ecosystem, TWMO has considered different plans to reduce the amount of waste entering the site to reduce dumped waste in Aradkouh to less than 30% in four years.

As part of the Integrated Waste Management Plan, Tehran has been divided into 8 regions, for each of which one Material Recovery Facility (MRF) should be built. Once completed, the waste generated in Tehran is no longer transferred to the south of the city, the leachate will be purified and dumped volumes will decrease. In November 2022, TWMO inaugurated the first MRF in Tehran. Although overdue, it is hoped that the new MRF help increase valuable dry waste volumes by 25%.

Dry Waste Management in Tehran

The volumes of dry waste in Tehran worth recycling differs from region to the other (15% – 20%). In the north of Tehran where more affluent households live, dry waste generation rate is higher than those in the southern parts of the city. Meanwhile, dry waste is normally collected through various ways: 1- segregated at source and delivered to recycling kiosks by households; 2- collected by official contractors of the municipality at source; 3- collected by informal waste collectors at dumpsters. It is estimated that the network of informal waste collectors exceeds 14,000 workers of which 4,700 are children. About 80% of these children are believed to be of foreign nationalities mainly Afghan (2020). The waste mafia in Tehran is estimated to earn over €200k per day. That is why recyclable dry waste reaching Aradkouh is around 5%-6% only. To redress the situation, TWMO has diversified dry waste collection at source by allocating individual dry waste dumpsters to residential, commercial, educational

centers and religious service centers as well as offices. Meanwhile, chain stores, factories and companies producing bulk waste have been linked with official recycling contractors. 445 recycling kiosks across the city of Tehran receive a wide range of waste types from citizens including electronics and batteries. Around 100-200 kilograms of waste is collected by these kiosks. TWMO has also deployed a team in collaboration with the Judiciary to identify and block informal waste collection and trade although this remains a key challenge to tackle.

TWMO has also set up certain procedure to collect the organic waste produced by wholesale grocery centers in Tehran separately for compost production with the capacity of 80 tons per day.

Construction Waste Management in Tehran

For close to 90 years, construction waste & demolition debris generated in the city of Tehran has been dumped in Abali, in the northeast of Tehran. About 23,000 tons of construction waste is collected in the city of Tehran per day of which over 17,000 tons is transferred to Abali. Over 10,000 tons of such waste is recycled in 3 recycling centers into sand and concrete pieces. Of the remaining 6,000 tons, 3k tons is sent to Aradkouh to be either dumped in the landfill or used as cover for unrecyclable or rejected municipal waste. The rest (3k tons) is dumped across the city of Tehran for which legal permission has been issued.

TWMO is planning to install a new incinerator (1,100-ton capacity) in the Abali Waste Management Center as well as two more recycling centers (3,300-ton recycling capacity). Currently, there is only one Iranian company with knowledge of incineration technology. TWMO hopes to cooperate with the Chinese companies to purchase the necessary equipment.

Hospital Waste Management in Tehran

Waste Management Legislation (2004) defines medical waste as infectious and harmful waste generated in hospitals, medical centers, laboratories and similar institutions. Based on the relevant guidelines and regulations, medical waste should be collected, segregated, autoclaved and packaged at source and then stored in dedicated dumpsters where they are picked up by special TWMO contractors.

Monthly medical waste generation in the city of Tehran is between 3,900 – 4.100 tons of which 2,100 tons is infectious and the rest are treated as normal or quasi-household waste. TWMO has allocated 55 mechanized vehicles specialized in medical waste transport which collect the waste in three shifts per day. Of this number, 40 vehicles transport only infectious waste. The collected waste is transferred to Aradkouh where they are treated in separate

processes. Normal medical waste is disinfected and buried and infectious waste is buried in special burial cells/pits. It should be noted that three years ago both types of medical waste would be buried together but given the high costs, separate processes were defined. Based on the recent statistics (2022), there are about 12,000 centers in Tehran including 160 hospitals that produce infectious waste but only 4,500 have signed contacts with TWMO for collection of their waste as required by the law. In the absence of legal pressure, the remaining centers are yet to cooperate with TWMO which means their infectious waste could be mixed with the normal waste polluting the entire treatment chain. (i.e. doctor surgeries, beauty salons, rehabilitation centers, etc).

In **Annex I**, processes for management of different types of waste in Tehran from collection to disposal has been illustrated.

6. CHALLENGES

Although Iran's per capita generation of municipal solid waste per day is lower than many other countries including those in the developed world, lack of specialized recycling infrastructure, planning, attractive incentives and investment in the waste sector have impeded proper handling leading to serious environmental problems from air, soil and underground water pollutions by waste leachate to serious implications for the whole population living in the ecosystem.

In late October 2022, NASA detected a methane plume of at least 3 miles (4.8 kilometers) long billowing into the atmosphere south of Tehran where Aradkouh Waste Treatment Center is located. Later, the head of National Center for Air and Climate Change of the Department of Environment explained that "in 2020 under Clean Development Mechanism, a consortium of South Korean companies were studying the possibility of converting methane into energy in Aradkouh but due to the US sanctions, the Korean government withdrew from the project." As mentioned earlier, despite some pre-treatment works on the waste entering Aradkouh, volumes dumped in the site are still significant and the existing infrastructure and practices cannot respond to the needs of Tehran.

Other challenges facing the waste sector is the growing network of informal dry waste pickers and traders who collect most of the dry waste at the dumpsters. As mentioned earlier, in 2020, the number of workforces in this network was over 14,000 in Tehran only and the wave of immigrants from Afghanistan might have added to the number.

Lack of public awareness and participation in programs advocating waste reduction and segregation at source have further loaded the burden of the waste management system. Mixed processing of organic and dry waste and unprotected human involvement as a result of lack of mechanized solutions have led both to low productivity of the machines as well as health risks for the involved workforce.

Other factors contributing to the challenges include population growth, increased consumerism and production, inadequate landfill capacity and improper site selection in proximity of urban areas, lack of adequate processing, recycling and treatment infrastructure and as well as conflicting responsibilities of authorities and their contractors in the waste sector.

7. POTENTIAL AND OPPORTUTNTIES FOR INTERNATIONAL COMPANIES

International cooperation can be persuaded in the following fields:

- Installing incinerators, digesters, formal landfills, etc. through joint ventures with local companies
- Providing equipment/solutions helping curb methane emissions in landfills
- Providing technical training on modern waste management practices to local consulting firms
- Developing region-specific solutions for waste management in cooperation with municipalities
- Providing modern solutions, equipment, machinery for hospital waste management

8. LOCAL TRADE FAIRS

The 4th International Exhibition on Waste Management, Recycling, Machinery & Related Industries will be held from January 29 to February 1, 2023, in Tehran International Permanent Fairground. The trade fair brings together local companies and all the stakeholder involved in the sector together and is a good point of entry to know the players and the environment.

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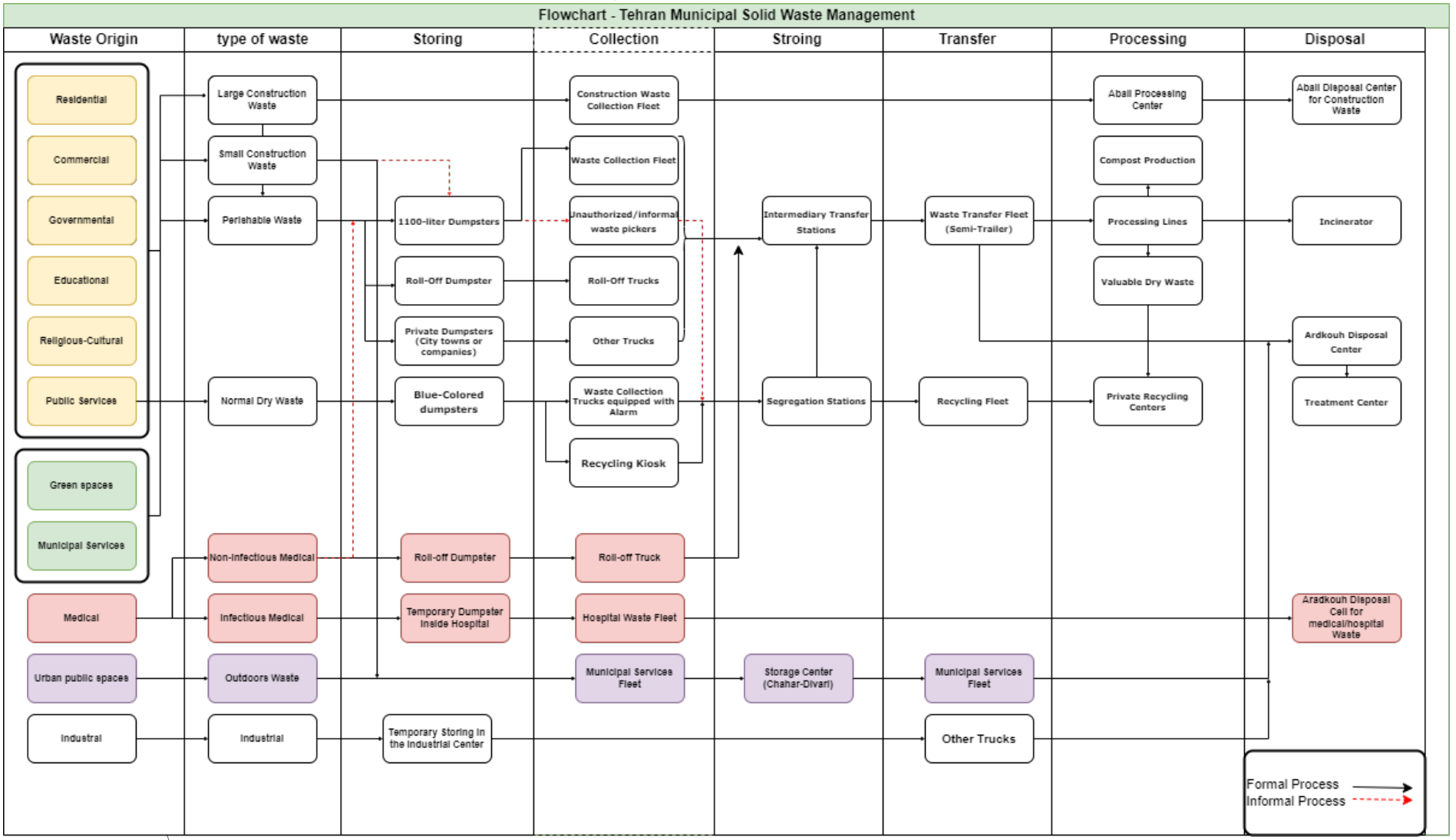
ANNEX I (source: Center for Governance & Society Empowerment,2020)



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