Iraqi Waste Management Centre (IWMC): A Study and a Proposed Solution for Solid Waste Management in Iraq

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Abstract. Iraq witnessed many wars and problems, resulting in a lot of waste harmful to humans and the environment. Poor handling of solid waste will lead to inevitable disaster. Most of the methods used are burning or landfill. This paper proposes the formation of an Iraqi Waste Management Centre (IWMC) to solve the waste problem and make it an important source of income and contribute to providing job opportunities and reducing the import of some raw materials from abroad by the method of integrated waste treatment, which depends on reducing waste disposal by raising the level of awareness of citizens and society by sorting, collecting and recycling of waste and the establishment, operation and maintenance of waste treatment facilities. A full suggestion for action plan produced here is represented by providing a full explanation of the most important tasks of this center, its Action, Contribution and Activities, who are the partners and the nature of their work, the risk they face, budget, and timeline for the duty entrusted to the center.

Keywords: Iraq, Sorting waste, Solid waste, Waste management, Recycling

Introduction

Most human activities produce wastes if the individual may decide a substance, is a waste. The production of waste despite that remains a major source of concern as it has always been for many centuries. Recently, the quantity and rate of waste generation have been taken great attention.

A fundamental increase in the volume of wastes generation began in the sixteenth century when people began to move from provincial (rural) to cities as a result of the industrial revolution (Wilson, 2007). The people's migration to cities produced a population explosion that in turn produce increasing in the volume and product variety in the structure of waste generated in different cities. As a result, things like glass and plastic began to appear in large amounts in municipal waste flow (Williams, 2005).

A large number of people in cities gave rise to random mixed and open waste. In turn, these dumps form a good ground for rats and other bugs, which led to significant risks to individual health. The wrong waste management produces several outbreaks of scourges and epidemics. As a result, public officials in the nineteenth-century started to control the operation of disposing of waste to safeguard individual health (Tchobanoglous & Theisen, 1993).

Today, most countries effectively handle many of the health issues and environmental problems associated with waste generation. The increasing rate of urbanization and developments in emerging countries leading to a repeat of the same problems that countries should have addressed in the past (Wilson, 2007).

Planning for solid waste management in third world countries was still a difficult task due to the fast and unregular growth of the population, unplanned urbanization, poor training in the modern methods used to waste management practices, lack of awareness of the dangers of unsustainable waste management practices, illiteracy, poverty, and poor support produce by the government. In addition to poor information related to waste management and a few research found related to this field are extra factors militating on planning for management (Nabegu & Wudil, 2008).

Iraq Waste Management

Iraq is one of the most populous Arab countries with a population exceeding 32 million. Rapid economic growth, high population growth, increasing individual income and sectarian conflicts have led to worsening solid waste management problems in the country. Iraq is estimated to produce 31,000 tons of solid waste every day with per capita waste generation exceeding 1.4 kg per day. Baghdad alone produces more than 1.5 million tons of solid wastes each year (Alnajjar, 2019).

Increasing waste generation putting massive stress on the infrastructure of Iraqi waste which has heavily damaged after decades of neglectable and mismanagement (Al-Dahhan & Mahmood, 2020).

Medical waste management is one of the big problems in Iraq especially in Baghdad as it represents the capital and the biggest populated city in Iraq and contains about 32% of the total hospital in Iraq. These hospitals generate about 0.5 kg/(bed·day) but unfortunately, there are ineffective, insufficient, collection, sorting, improper isolation, processing, and safe disposal of medical wastes (Montaze, 2020).

Although some hospitals have recently used the waste sorting process, there is still a need to expand and develop the sorting process. For example, the Quantity of regular waste generated from hospitals (governmental and private) that apply the sorting system (tons/year) was 19270.1, while the Quantity of normal waste generated from other health institutions that apply the sorting system (tons/year) was 2875.2 (Baghdad Mayoralty, 2022).

In the absence of an efficient way of handling waste and disposal infrastructure, most of the waste is treated in traditional unregulated landfills across many spaces in Iraq with no concern for environmental pollution and human health. Iraqi landfills caused groundwater contamination, spontaneous fires, large scale gas emissions, and surface water pollution.

In 2007 the National Solid Waste Management Plan (NSWMP) for Iraq was developed by a collaboration of international waste management specialists over the coming 20 years. The target plan shows the recommendations for development and explains the background for decisions. The main key principles of waste strategy development in Iraq can be summarized as (Knowles, 2009):

1. Policy development;
2. Integrated planning regarding regulatory framework;
3. Economic aspects, institutional capacity;
4. Citizen and technical education;
5. Technical and operational development.

The plan aims to build 33 landfills which they environmentally engineered have a capacity equal to 600 million/m3 in all the 18 governorates by 2027. The plane focused on collection and transportation, recycling, reuses, and disposable systems.

The ministry of environment also started in 2008 its own comprehensive development program. This program is a part of the ministry's efforts to enhance the environmental situation in Iraq. Ministry of Municipalities and Public Work developed and implementing solid waste management in collaboration with international agencies like UN Habitat, USAID, UNICEF and EU, in several Iraqi governorates such as Anbar, Kirkuk, Dohuk, Thi Qar, Sulaimaniya, Erbil, and Basra.

Although all of the above efforts given by international organizations, these efforts are still not enough to find a solution for the solid waste management problem in Iraq, these efforts gave a chance to provide some information regarding the size of issues for use later by the Iraqi government hopes to develop the Iraqi national waste management plan with the support of organizations such as UN-Habitat, UNDG Iraq Trust Fund, and USAID.

Iraqi Waste Management Centre (IWMC)

In order to achieve the desired goals of the plan, determine who is responsible for enacting laws, and identify work teams, a Waste Management Centre affiliated with the Ministry of Environment is suggested here.

To understand the scope of the center, it must include awareness campaigns, encouragement, transfer of successful experiences, legislating new specific laws, and fee's imposed but should be excluded all the traditional methods of burning and landfill, mixing waste, contracting with inefficient companies to achieve a personal benefit, applying the plan to an area without another

This center is responsible for developing and studying plans, determining priorities, forming work teams and budgets, having branches in all provinces and municipalities, encouraging volunteers to spread awareness, contracting with good and trust companies, preparing lands outside the city for waste collection and recycling and many other duties and activities which can be illustrated in Table 1.

Table 1. Main IWMC Interests and activities

Interests	Action, Contribution and Activities
Budge Orientation Issuing permits Approve resources Prepare locations Monitoring and supervising the work of the private sector	• Paying salaries, training workers in this field, and awareness campaigns. • Lawmaking • Charging fees • Establishment and prepare the land for waste collection • Determine the budget • Awareness campaigns • Exchange experiences and hear a new ideas and suggestion. • Focus on priorities. • Provide training, where needed. • Establish a problem-solving environment. • Encourage creativity and experimentation. • Show support and commitment. • Provide rewards and incentives. • Involve in testing, validation of progressing. • Roll out reviews • Observe the project income and outcome. • Getting access to relevant stakeholders.

Stakeholders

Any successful project needs stakeholder(s) to cooperate with the responsible to achieve the desired objective. A large project like waste management needs more than one stakeholder. The main stakeholders that need to work with the center are: Citizens, Educational institutions, Municipalities, Private sector companies, international parties, volunteers, and civil society organizations. The main jobs of private sector stakeholders are:

1. Preparing studies and providing environmental consultations
2. Collection, transportation and sorting of municipal solid waste
3. Provide waste pick-up and transport vehicles
4. Analysis and monitoring of water, air, soil and noise quality
5. Transportation of industrial and hazardous waste
6. Treatment and disposal of industrial and hazardous waste

7. Prepare a hotline, mailbox, and website to receive complaints
8. Open, honest communication
9. Desire to learn from each other
10. Concentrate on team building

To understand and analyze the stakeholder's responsibility, Table 2 described the mapping of the stakeholders by definition what is interests, action, contribution and activities.

Table 2. Stakeholders Interests, Action, Contribution and Activities

Stakeholder group	Interests	Action, contribution and activities
Citizen	• Can reach the largest possible number of citizens. • Giving support during implementation. • Facilitate the work for the teams.	• Sorting household waste. • Making a point to buy only post-consumer recycled products. • Encouraging of using recycling material. • Encourage people to express their feelings about how to start sorting waste and the problems they face
Educational institutions	• Can reach Quite a number of educated people • Understand why it's needed. • Giving support during implementation. • Convincing the denial parties by clarifying the international experiences	• Including topics talking about recycling, Implementing practical lessons for primary school students • Instilling a culture of sorting and recycling. • Encouraging of using recycling material. • Facilitating holding of seminars and conferences. • Encourage people to express their views about how to achieve the change. • Redesign workshop. • Interviews.
Municipalities	• Provide an effective and efficient system to the inhabitants. • Establishment use and aftercare of disposal sites.	• Organizing the management of waste generated in residence and service functions. • Arranging the recovery and treatment of hazardous waste generated in the neighborhood. • Providing information and advice on the waste management services for which they are responsible. • Municipalities charge waste holders for the costs of the waste management they provide. • The municipality imposes fees for waste and sets fines. (The waste charge shall correspond to the service level provided by the municipality) • Prepare hotline, mailbox, and website to receive complaints
Private sector companies	Make a profit for the company	• Providing color containers for each type • Raise garbage daily • Providing vehicles to pick-up waste. • Building factories for waste treatment and power generation. (Renewable energy) • Treatment and disposal of industrial and hazardous waste. • produce full information about plan: Whose responsibility is this? Who is leading the way? • Allow people to implement their ideas if it is in the interest of the project

International parties	Give the innovative ideas and solutions	• Staff training • Transfer of successful experiences • Open, honest communication • Desire to learn from each other • Concentrate on team building
Volunteers	Citizen awareness Carrying out some simple work	• Contribute to awareness • Raising waste if the responsible party is unable to
Civil Society organization	Citizen awareness	Contribute to awareness

Consultation Structure for Stakeholders

To understand the consultation of the group around the plan, the objectives, tasks, activities, and participants must be assigned. It is possible to hire and benefit from the expertise of the international companies in this field with conjunction of the researchers and experienced people from the country.

The consultation group can give the innovative ideas in presenting projects and solutions that are applied on the ground to solve the problem of waste treatment that which be used to achieve profitability that helps in obtaining raw materials at a low price and contributes to reducing the costs of production and manufacturing costs and reduces the amount of energy wasted in the production process and also it is beneficial for preserving the environment and the health of the people. Of course, the citizen is the most stockholder who has the most benefit as long as all these things aim in the end to serve him.

Risk Analysis & Risk Management

The most important risks associated with solid waste management can be divided into two parts:

First: risk produced by change resistance which produces because of:

- The risks of fighting change by citizens due to changing their behavior habits of dealing with waste
- The citizens do not have a vision of the project objectives, negative perceptions.
- They don't trust the government promises especially if they had a previous experiment
- There is no noticeable progress on the ground.
- Dramatic decrease in performance.

Actions should take to minimize the change resistance risk:

- Explain the change (public value, significance, expectations).
- Explain what will change and what will not.
- Give people time to absorb the change.
- Encourage people to express their feelings about the change constructively.
- Encourage people to express their views about how to achieve the change.
- Set short-term goals.
- Establish a problem-solving environment.
- Encourage creativity and experimentation.
- Show support and commitment.
- Compare results of the current stage with others in previous stages.
- Listen actively.
- Exercise patience.
- Prepare for the next change.

Second: Concrete risks such as physical risks, occupational accidents, biological risks, chemical risks, and psychological risks. The health risks either to the worker directly involved or to the enterprise operators

- The nature of raw waste, its composition (e.g., toxic, allergic, and infectious substances), and its components (e.g., gases, dust, leachates, and sharps)
- The nature of waste as it decomposes
- The handling of waste (e.g., shoveling, lifting, equipment vibrations, and accidents).
- The processing of wastes (e.g., odor, noise, accidents, air and water emissions, residuals, explosions, and fires).
- The disposal of wastes (e.g., odor, noise, stability of waste piles, air and water emissions, explosions, and fires).
- Large budge: Usually recycling is not a low-cost process in all cases. Building a waste recycling unit requires a large budget and training the local people by providing useful programs and seminars
- Some recycled products just aren't as good: recycled products are not equal in quality, as this type of product is made from materials that have been used excessively, and this makes such products less quality and at lower prices.
- Fires Risks
- There is no obligation from the public to sort out the materials

Actions should take to minimize the concrete risks

1. Transfer of environmentally sound technologies and know-how clean technologies and low-waste production.
2. Study the External and internal storage stack sizes and separation distances.
3. Safe management of hazardous waste.
4. Initiatives to treat, recycle, reuse and dispose of wastes at the source of generation and regulatory mechanisms (Polluter-pays principle).
5. Procedures for environmental impact assessment, taking into account the cradle-to-grave approach.
6. Establishment of combined treatment/disposal facilities for hazardous wastes in small- and medium-sized industries.
7. Prevention of landfilling combustible and organic waste.
8. Landfill tax.
9. Development of environmentally sound disposal facilities, including technology to convert waste into energy.
10. Initiatives to encourage recycling of waste and the purchase of biodegradable plastics, and buy products that can be used more than once instead of once and discarded (i.e. drink coffee with regular cups, rather than throw away paper cups).
11. The responsibility of the municipalities and the concerned authorities for the awareness process and the distribution of plastic bags to the residents to facilitate the sorting process, with specific colors.
12. A fine for anyone who does not comply (The presence of fines, and strong laws on violators, will increase the number of obligors)
13. Including topics talking about recycling, implementing practical lessons for primary school students, and instilling a culture of sorting and recycling.

Information and Communication

The communication plan can be arranged as the following

- Assessment of the current situation

- Document data on people, development, and future trends.
- Developing a plan for management in the area concerned in cooperation with the relevant authorities, including the private sector and environmental associations, with the approval of the local government.
- Determine the type, quantity, and source of waste generated, treated, or intended to be disposed of
- Financial matters and institutional framework
- Determine the geographical scope of the areas to which the services will be provided and the requirements and needs of each region.
- Study suggestions and complaints submitted by citizens regarding municipal waste management.
- Conducting the organizational evaluation for the logical distribution of solid waste management employees on the various tasks at each stage of the work
- Continue to communicate what will and won't change
- Encourage open input
- Support teamwork

Budget

In the beginning, this suggested project needs a budget for awareness campaigns and the provision of special containers and intermediate stations to collect the sorted waste. After that, the project turns into a source of financial profits resulting from the sale of waste, use in recycling, and a source of fuel to generate electric power.

As it appears in the timeline of the action plan figure.1 (preparing eligible land, distributing colored waste containers, and hiring private companies will take approximately between 7-8 months). The government or the provincial council should pay all the costs.

The best solution is to sell the waste at low prices, for one purpose, which is to benefit all parties (the citizen, the waste recycling company, the environment, and the economy). Here we are talking about a government program that organizes private sector projects in recycling waste of all kinds.

Planning

The suggested center is responsible upon provide a plan to manage solid waste, these plans is preferring to be short-term running and achieve tangible and clear goals to the public in order to provide an opportunity for the public to increase their faith in the goals of the plans set and increase confidence between the government and the people.

The following study plan is a model that can be carried out for provincial or municipalities:

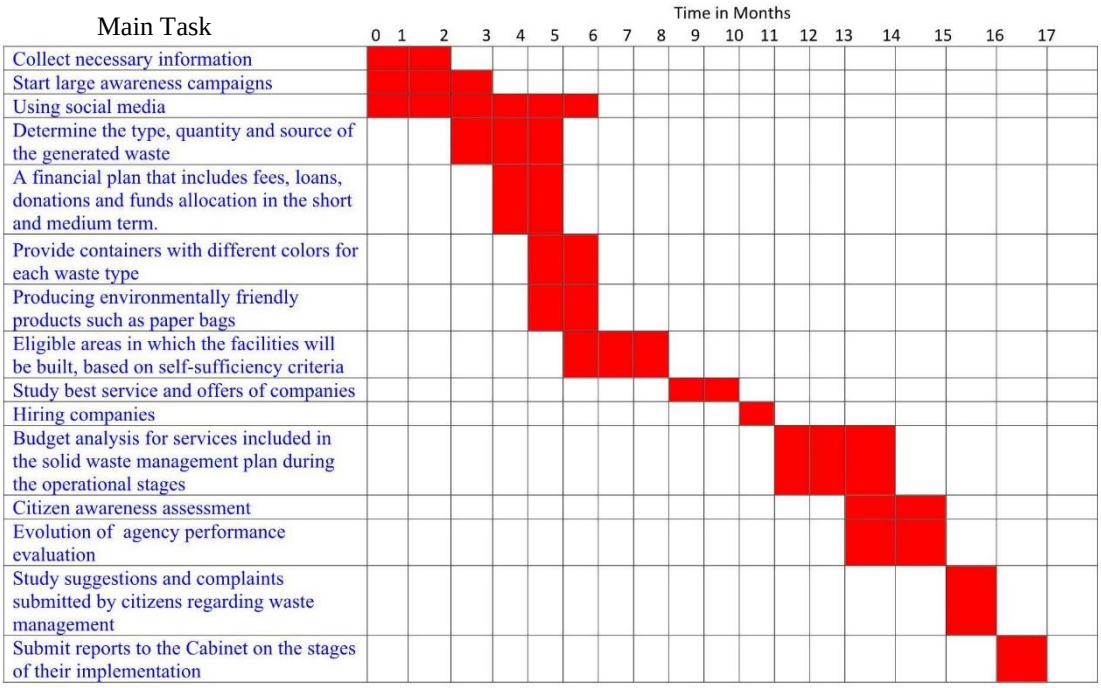

Figure 1. Timeline of the action plan implemented across the province or municipality

The team's member responsible for the task of the plan of the figure (1) is described in Table 3.

Table 3. Team member of each plan task

Task	Team member
Collect necessary information	The team leader, the responsible for recycling material, administration and survey team, and the responsible for landfill
Start large awareness campaigns	The team leader in cooperation with team members who have the ability to persuade others, making the interviewer and provide evidence
Using social media	Technical members
Determine the type, quantity and source of the generated waste	Operation Manager, Site Engineer, Administration and Survey Team
A financial plan	Principal of the project
Provide containers with different colors	Principal of the project, Subcontractors
Producing environmentally friendly products	Principal of the project
Eligible areas	Principal of the project
Study best service and offers of companies	Principal of the project in cooperation with the specialists from the team
Hiring companies	Principal of the project
Budget analysis	Principal of the project
Citizen awareness assessment	Health, Safety and Environmental Engineer
Evolution of agency performance	Environmental Team

Study suggestions and complaints submitted by citizens	Citizens service manger
Submit reports to the Cabinet	All team member prepares the report, submit by project manager

Conclusion

Management and disposal of solid waste in Iraq have been investigated and appear it suffer from a dilemma that must find appropriate solutions.

The problem has reached a stage that cannot be ignored or delayed, but it has become a daily problem that must be eliminated as soon as possible because of the great damage it causes to the health of the individual, society and the environment in which they live.

We should answer these questions: what exactly can be considered as a waste? How much do we know about how to handle waste? This paper seeks to answer these questions and provide some solutions and suggestions.

The proposed center is responsible for solving all problems related to waste management and sorting starting from the source to the final destination. This center is responsible for facing the challenges and ensuring regular evacuation of the wastes in those dump sites.

The findings and suggestions presented in this paper will serve as useful guides for improved waste management services within the country.

After clarifying the various options for waste management and presenting the proposed center, it is the responsibility of the stakeholders, especially the municipal authorities and concerned individuals, to take the necessary practical steps to implement them. It is necessary for the municipalities to establish partnerships with each other in order to reduce the financial and administrative burdens of such a plan.

This cooperation helps reduce the economic costs of waste management, which leads to facilitating the implementation of sustainable management by municipalities or even districts.

In addition, it is important that individuals actively participate, whether at home or at work, to contribute to Iraq's transition to sustainable waste management. For this, citizens must bear the burdens and responsibilities accompanying this transformation and start implementing the recommendations of the proposed plan in their daily lives, most notably sorting from the source.

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