

Sustainable-Business Waste Management

A case the Emirate of Ajman – UAE

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Abstract

Waste is an unavoidable product of society, and it is a challenge to realise how to manage significant quantities of different types of waste in a way that has benefits for society, the economy and the environment and governments are facing a formidable challenge in trying to find solutions. Due to the continuous increase in population and the standard of life as well as industrial development, the UAE Government, like others, has the challenge of managing large quantities of different types of waste. Besides, there exists a lack of waste management correlated with business opportunities policies and practices in the UAE. This paper discusses how these challenges can be overcome, resulting in benefits for the society, the economy, and the environment when introducing well-designed waste associated business models to the local and national markets, new waste management model framework correlated with business. To achieve the aim of the study and to eliminate researcher's and participants bias, mixed method data collection were used in this research. Empowering industries to manage waste have been argued as the most innovative and practical approach to waste management strategy set to get businesses to place sustainability at the top of their priority list. This does not only help extend producer responsibility but creates a circular economy that retains the value of materials within the economy. Renowned benefits, therefore, exist for the Emirate of Ajman if industries are empowered to manage waste; these benefits go beyond the reduced level of waste sent to the landfills and incineration sites but have leveraged benefits to the economy as a whole, it is also concluded that the primary factors and practices that possibly can enable the business sectors to recycle and reuse maximum quantity of the total waste produced from the Emirates of Ajman by introducing a comprehensive business development model.

Keywords

Waste Management, Ajman, UAE, Waste-Business, Sustainable waste management, Waste modelling.

Background

Waste is an unavoidable product of society, and it is a challenge to realise how to manage large quantities of different types of waste in a way that has benefits for society, the economy and the environment and governments are facing a formidable challenge in trying to find solutions [1]. There are different types of opportunities for new business models to be applied to waste-related markets [2]. Greater cooperation between the authorities and businesses, involving joint teams from different sectors of municipal departments and industries are to be within the ways of going forward. As the worldwide economy revenues to grow, the United Arab Emirates' businesses must have a proper strength in order to take advantage of the emerged opportunities in all aspects. Procurement, trade and benefit will play an essential role in developing markets and generate demand for new products, systems and facilities. For this study and to approach a framework model to support authorities set up initiatives to commercialise waste management and introduce opportunities for local and global business, the Emirate of Ajman is to be selected for two reasons: the first reason is that this Emirate is intending to start an intensive effort to develop waste-business correlations which give this work originality and the second reason is primary and secondary data are available and accessible.

The importance of this study is that it will further benefit the future planning and development of the United Arab Emirates in the waste management and associated business sector.

This research work aimed to Empower industries to manage waste which have been argued as the most innovative and practical approach to waste management strategy set to get businesses to place sustainability at the top of their priority list [3][4]. This does not only help extend producer responsibility but creates a circular economy that retains the value of materials within the economy. Renowned benefits, therefore, exist for the Emirate of Ajman if industries are empowered to manage waste; these benefits go beyond the reduced level of waste sent to the landfills and incineration sites but has leveraged benefits to the economy as a whole.

Methodology

As per the main aim of this research work is to empower industries and private sectors to support waste management. This is for the benefits to go beyond the reduced level of waste sent to the landfills and incineration sites and consequently has leveraged benefits to the economy. It is, therefore, essential to implement a regulatory framework and policies to support businesses in expanding the evidence base across a variety of consumer sectors, taking into account the repair, maintenance and service opportunities [5]. The research methodology includes collecting, analysing and integrating quantitative (surveying, questionnaires and experimenting) and qualitative (interviews) research work. The reason behind this initial thought of hybrid methodology is that it will enable the researcher to collect and analyse both numerical and non-numerical data [6]. The research methodology will, therefore, use

a sequential exploratory research design to establish evidence in the area of study. This variant of the mixed methods ensures that qualitative data is first collected with the help of interviews. The resulting outcome of both the qualitative and quantitative triangulated and integrated to arrive at key study conclusions.

Waste status in the Emirate of Ajman

Due to the continuous growth in population and the standard of life as well as the industrial development in the United Arab Emirates Figure 1, [7], a sharp increase in the municipal and industrial waste have resulted, see Figure 2, [7]. Figure 3, [7], shows the ongoing waste streams (2010 – 2020). Figure 4, [7], shows the forecasting of all waste in the Emirate of Ajman. All these issues are forming a big challenge to the Government at the present and future. Each Emirate of the UAE must develop its own waste management. Consequently, a new approach to this development is needed.

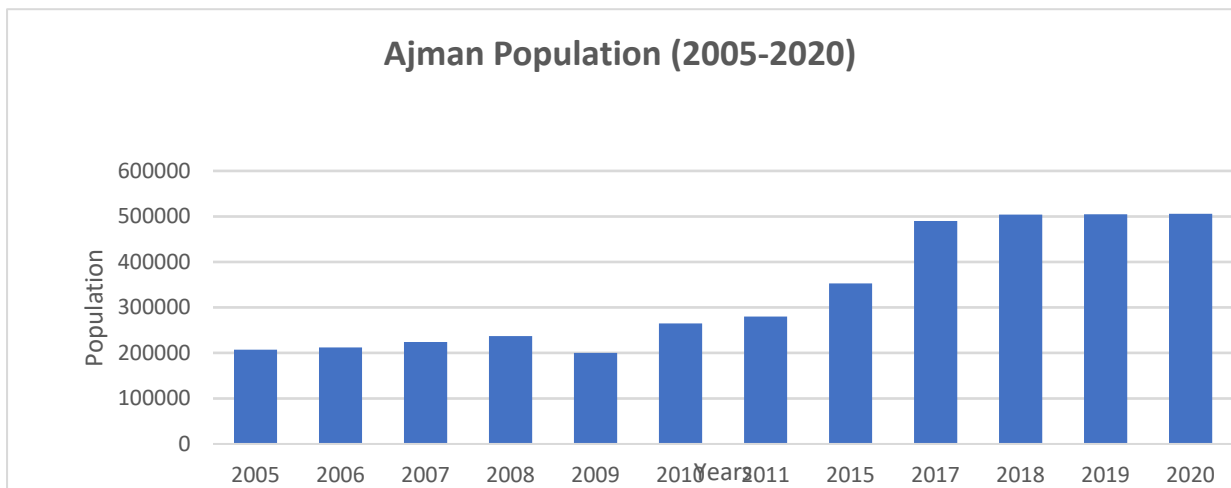


Figure 1 Ajman Population from (2005-2020). [7]

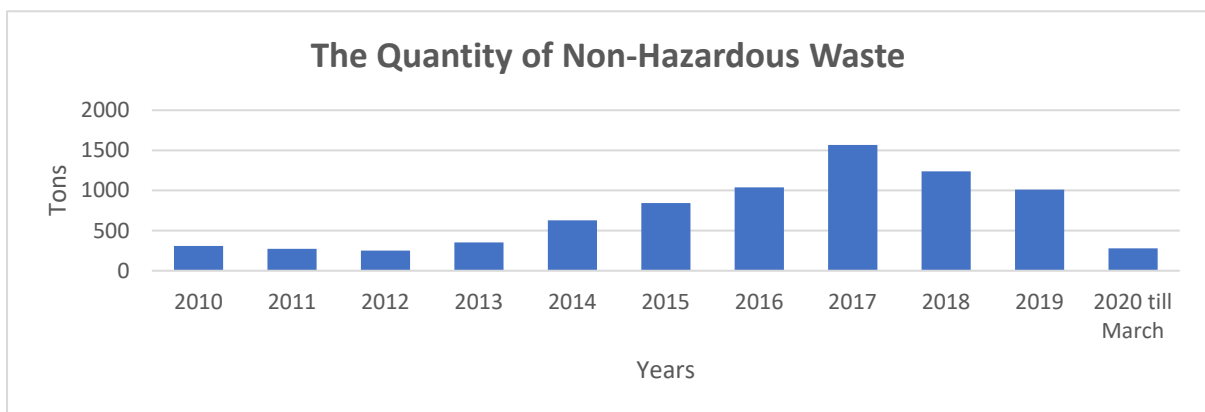


Figure 2 The quantity of non-hazardous waste. [7]

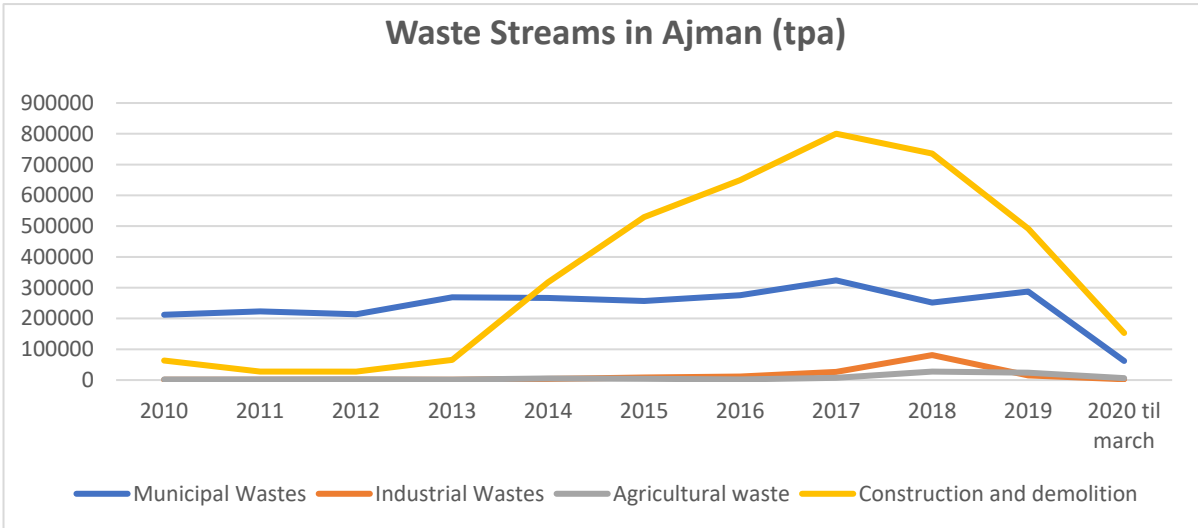


Figure 3 Waste streams (2010 – 2020). [7]

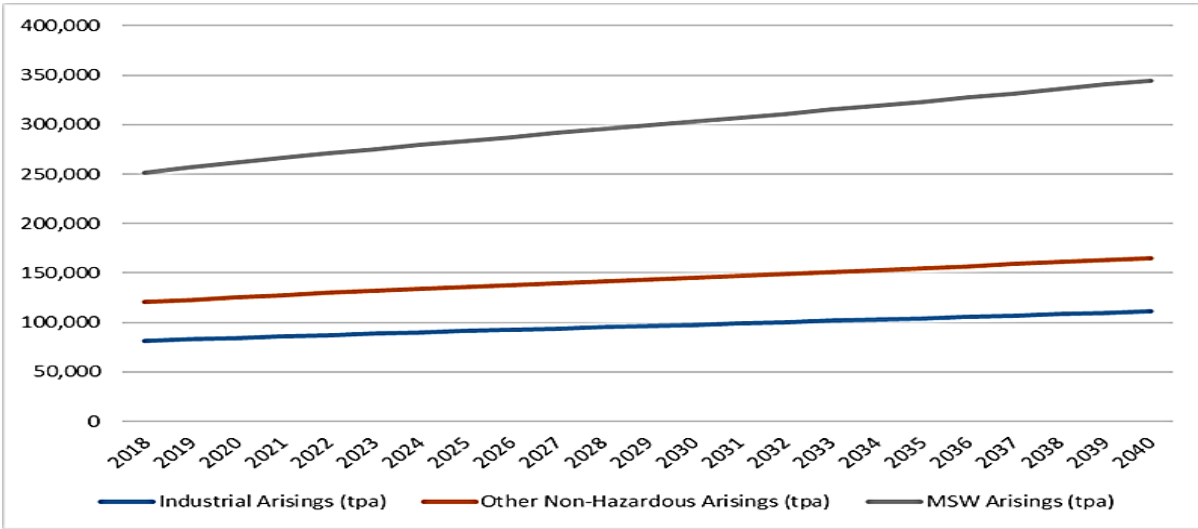


Figure 4 The growth of three waste streams in Ajman until the year 2040. [7]

The primary waste streams in the Emirate of Ajman are characterised as follows [7]:

- MSW – waste generated by household residences, commerce, offices and public institutions
- C&D
- Industrial
- Tyre
- Agricultural / green
- Sludge
- Hazardous - residue or ash resulting from activities and operations containing hazardous materials or properties of hazardous substances
- Medical / clinical
- Other

There exists a lack of waste management correlated with business opportunities policies and practices in the UAE. Therefore, this research seeks to understand the present waste situation for a selected city, quantifying its waste and types, then modelling solutions to create business opportunities in order to minimise the waste and improve the business sectors economic aspects, which will have positive consequences on the society and results in a better environment. In addition, the research aiming to promote an appreciation that both the economy and environment can benefit from carefully considered waste management practices, which will, in turn, lead to the sustainability of resources and the preservation of the environment, particularly considering the existential threats to the global environment faces today. Moreover, Municipal waste management companies compete and function in institutional environments that occasionally let them act on markets. At the same time, in other cases prohibit them from using the full capabilities of their expertise in resource management and infrastructure in an economically competitive manner [8]. This has limited some opportunities for them to expand with strategies for waste management and business marketing aspects. A proposal for a centralised waste management system with a theoretical framework was introduced, which implements an intelligent sensor-based substructure for waste separation and collection at the right time [9]. This proposal can fill in the present gap that the waste management system has in many cities and Ajman is one of those cities.

Converting the practices for waste management in a way that can attract the private and the public sectors to invest and create initiatives for business opportunities could well help sustain the waste management process and reduce the associated problem with liquid/solid waste accumulation, resulting in a more favourable impact on the environment. The UAE needs to introduce different strategical practices and ways in which the authorities shape the markets in which the local and international businesses operate. Moreover, The use of material resources and waste needs to be looked at carefully within the operation of business factors to help understand the type of barriers and required motivations for more efficient resource use is to be focused on with best practices and methods to overcome the obstacles [10]. In addition, a need for identifying business opportunities throughout the supply chain, from product design and manufacturing to materials management, recovery and reuse, which formed another objective of this research [11]. All these are never studied thoroughly and create a gap to be filled by this research study.

Emirate of Ajman location and Industrial Waste

Ajman is the smallest Emirate in the north of UAE. Figure 5 shows the use of land which is distributed in a way that totals 3,076 plots that has two plots for multi-use, 28 commercial, 2,617 residential, 7 of recreational & touristic, 391 industrial and 31 agricultural plots. Due to the continuous increase in population and the improved lifestyle, these figures are increasing, indicating the spread of waste associated problems and challenges. This has to be monitored, controlled, and has a proper sustainable management framework model.

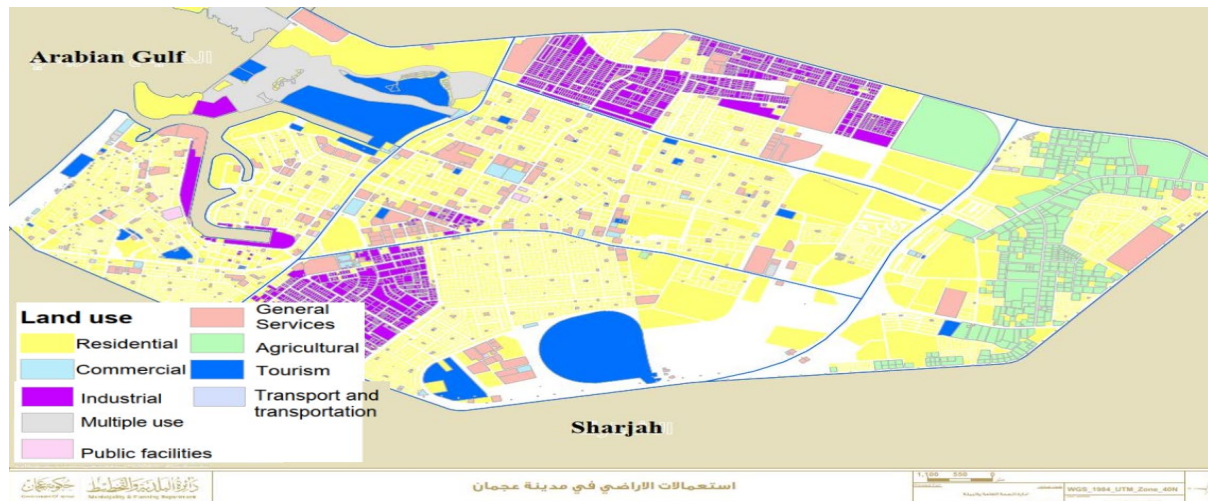


Figure 5 Emirate of Ajman [9]

Despite having the Emirate of Ajman's area is small, the Emirate enjoys a significant amount of industrial activities which consequently add more challenges to the waste management. At the same time, it explores many opportunities for the waste association business needs proper regulations, policies and business organising to achieve sustainable waste management. Table 1 (produced by the author), shows a list of the available industries with their waste-related activities 1 being the high productive capacity of waste and 0 being the low productive capacity of waste.

Table 1 Industrial activities firms in Emirate Ajman [7]

# of industries	Activities (English)	waste production
52	Plastic bags industry	1
42	Building metal works Industry	1
42	Lubricant industry	1
39	Grease industry	1
36	Home Furniture Industry	0
28	Manufacturing of kitchen furniture and fixtures Industry	1
28	Manufacturing of kitchen furniture and fixtures	0
23	Manufacturing of wooden doors and windows Industry	1
22	Household linen industry	0
19	Metal products coating industry	1

17	Manufacturing of tissue and paper towels	1
16	Metal construction industry	1
16	Industry of bottles and plastic containers	1
14	Manufacturing of fire resistant wooden doors Industry	1
14	Detergents and disinfectants Industry	1
13	The women's clothing industry	0
13	Office furniture industry	0
13	Making containers and boxes from cardboard	1
13	Making containers and boxes from cardboard	0
12	Men's clothing industry	0
7	Central & retail gas filling Industry	0
7	The manufacturing of fiberglass boats Industry	1
7	Children's clothing industry	0
7	Mirrors and glass cutting industry	1
6	Steel tubes industry	1
6	Aluminium foil and coil industry	1
5	Plastic sheeting industry	1
5	Sand brick industry	0
5	Tires recycling Industry	0
4	Installing pipelines and specialised installations	1
4	Steel pipe fittings industry	1
3	Gases industry, liquefaction and filling	0
3	Maintenance of fiberglass products	1
3	Car upholstery industry	1
2	petroleum gas Filling Industry	1
2	Metal ships industry	1
2	Repairing of Boats	1
2	Metal boxes industry	1
2	Manufacturing of marble products for decoration	1
2	Calcium carbonate powder industry	1
2	Artificial marble industry	1
1	Manufacturing offshore platforms and drilling towers	1
1	Ship repair and maintenance Industry	1
1	Repair and maintenance of ship engines	0
1	Manufacturing of wallpaper and wall coverings	1
1	Manufacturing of iron castings Industry	1
1	Manufacturing of rolled stainless steel sheets and coils	1
1	Manufacturing of vials Industry	1
1	Mosaic tiles industry	1
1	Nets making industry	0
1	Stone cutting and grinding industry	1
568		

Ajman Municipality Waste and Public Health Department

The organisational framework of the Public Health and Environment Sector is demonstrated within Figure 6 and the organisational chart of the Waste Management and Public Health Department provided in Figure 6.

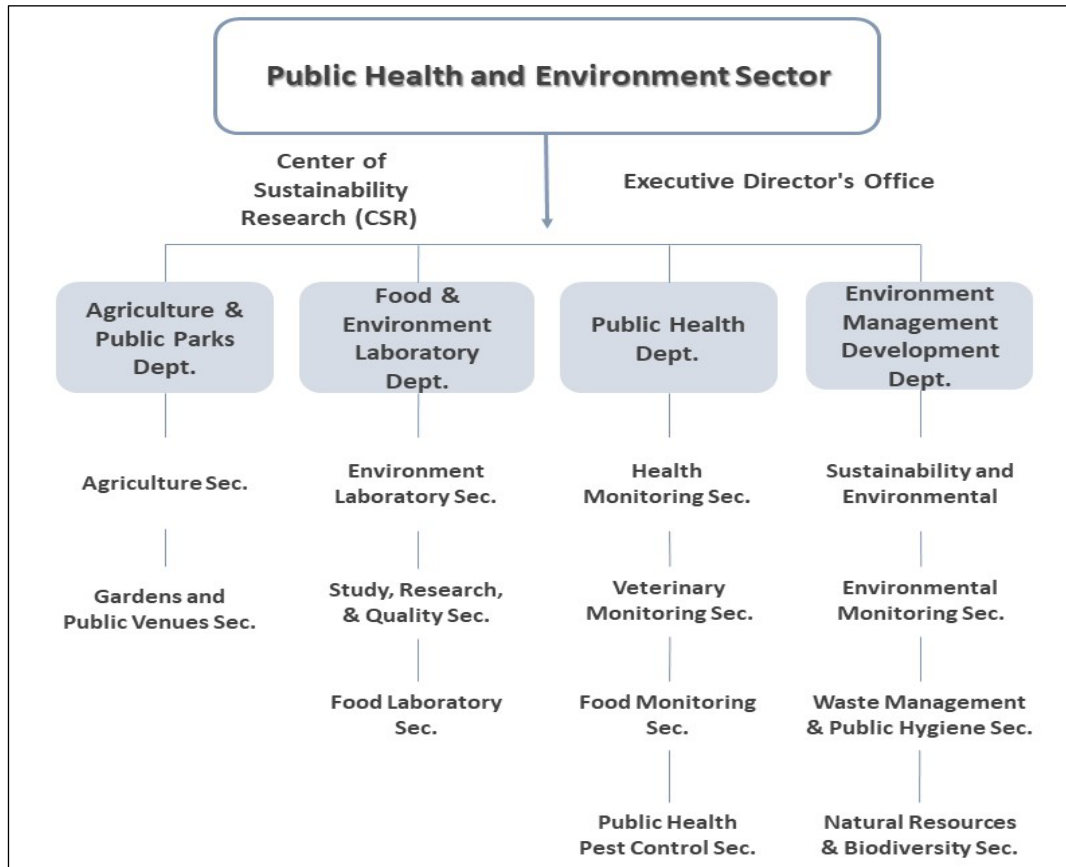























Figure 6 Ajman Municipality Public Health and Environment Sector organisational Framework

Ajman Municipality's Strategic Goals and Most Important Material Topics and the SDGs

United Nations Sustainable Goals (SDGs), have been seriously considered by the UAE aiming to achieve economic growth, Environmental benefits and Social wellbeing working for the best of the present and future generations. Waste management also has substantial attention, facilitated by the implementation of smart advanced technology with the required regulations and proper initiatives to achieve sustainable waste management. Therefore, empowering the right business for overall topics associated with the waste corresponding practices is an essential goal for the Emirate of Ajman in specific. All the factors mentioned above are necessary for an effective Waste-Business interrelation framework model. Table 2 shows the guiding topics and corresponding goals to support this argument [12].

Table 2 Ajman Municipality's Strategic Goals and Most Important Material Topics and the SDGs [12]

Ajman Municipality's strategic goals and the SDGs		
The Municipality's Strategic Goals	Description	Relevant SDG
G1- Achieve integration between infrastructure and residential elements	Sustainable environment while developing a modern infrastructure in Ajman.	 SDG 7: Affordable and clean energy  SDG 11: Sustainable cities and communities
G2- Qualify and protect the environment		 SDG 2: Zero Hunger  SDG 13: Climate action
G3- Manage the wastes efficiently and effectively	Empowerment	 SDG 11: Sustainable cities and communities  SDG 12: Responsible consumption and production
G4- Develop the Biological diversity	Transparency and Integrity	 SDG 11: Sustainable cities and communities  SDG 15: Life on land  SDG 16: Peace, justice and strong institutions
G5- Ensure best use of resources	Teamwork	 SDG 6: Clean Water and Sanitation  SDG 11: Sustainable cities and communities
E1- Develop human resources	Loyalty and Belonging	 SDG 5: Gender Equality and Women's empowerment

Ajman Municipality's Most Important Material Topics and the SDGs		
Aspect	Description	Relevant SDG
Most Important Material Topics	Infrastructure and Roads (Reduce Traffic Congestion)	 SDG 9: Industry, innovation and infrastructure  SDG 11: Sustainable cities and communities
	Waste Management Practices	 SDG 13: Climate action  SDG 14: Life below water  SDG 15: Life on land
	Community Health and Well-Being (i.e. Food Safety, Air Quality)	 SDG 3: Good health and well-being  SDG 13: Climate action
	Climate Change and Energy Efficiency	 SDG 7: Affordable and clean energy  SDG 13: Climate action

Environmental topics are recently intensively considered by many companies aiming sustainable development achievements. Therefore all customers, shareholders, employees and owners are inquiring on the practices and methodologies that can be implemented in order to deliver sustainability. Waste business over the world are placing strategies to be competitive and governments are also setting up initiatives and regulations to support this development and empower the waste business aiming to reach a sustainable waste management [10]. Ajman authorities are considering many initiatives such as organisational strategy is essential to creating long-term value for our ecological, social and economic environment. Moreover, initiatives are to

achieve a significant waste reduction and encouraging reuse and reducing food waste. Other practices are avoiding single use packaging, recycling as many items of waste as possible and even the residues from energy recovery can be used as aggregates in road building reaching zero landfill consequently allowing waste business associated companies to examine the actual business benefits of shifting to a more sustainable model [13].

Sustainable Waste Management, Sustainable Business - Key Factors & Smart Waste for Ajman Municipality

The increased growth in lifestyle and urbanisation leads to a growing to the economy and consequently increasing opportunities for growing waste associated business market. The main factors behind the sustainable development of this market would be the minimum impact on the environment, creative ideas for the implementation of smart technology, waste disposing efficiency, garbage monitoring, transportation, treatment, and transportation. Many challenges are arising; important ones are comprising a need for advanced infrastructure, and advanced smart technology needs to be implemented to support this advanced. In order to achieve the improved operational efficiency of waste management lifecycle. As global smart waste management is sharply expanding and expected to reach a market value of 7,877 Million in 2025, see Figure 7 [14]. This increased expansion opens wide the available facilitated technological aspects that support the advanced waste market and enable the Ajman municipality to use the latest advancement in smart waste management.

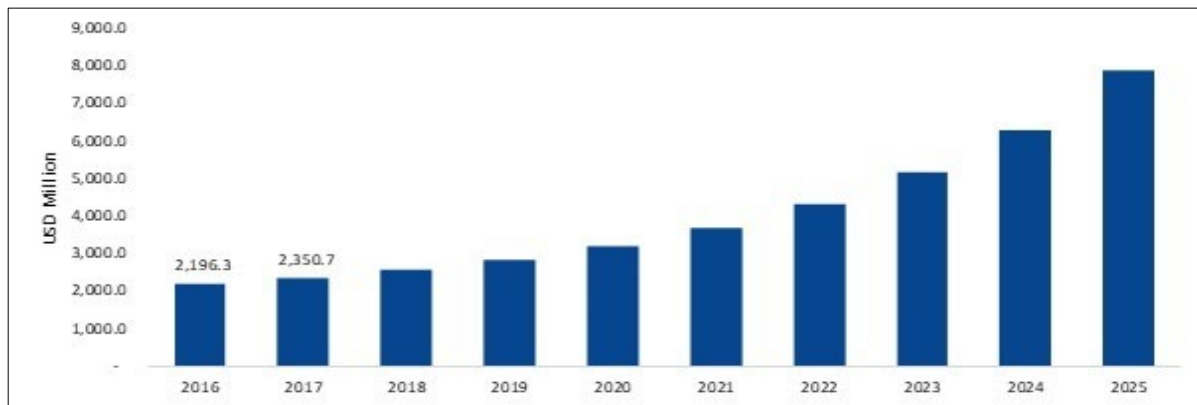


Figure 7 Global Smart Waste Management Market expectation [14].

The management of waste in critical spaces requires that this is done sustainably to render embedded economic, social, and ecological rewards [15 and 16]. This requires that waste is first seen as an unavoidable product of the industrial activity, and managing waste remains a formidable challenge that requires a strong alliance between private and public partners to find amicable solutions [17]. In Ajman, key initiatives have been introduced to make the area of waste management attractive to private investors [18]. Nonetheless, to ensure that waste management is integrated into the very industry systems and structures that currently exist, these industries must be empowered enterprises to manage waste through the reduction, reuse, recycling,

and repurposing of waste in a manner that meets all the three dimensions of economic, social, and ecologic sustainability towards overall reduced environmental impact. This analogy remains a central aspect of the Ajman Municipality Sustainability model, as suggested in Figure 8. The model shows a flow of roles and practices starting with the governmental activities such as the required practices, the incentives that are provided to empower business, regulations to control these practices with factors that support practical cooperation and the export and import activities. It follows that the Municipality will take all the required data and analyse to practically perform the regulations set up by the Government according to standards referred to each activity for quality assurance to cover the private business sector and industrial sector. This shows how well could the waste management can be performed in a sustainable way when applying this model that specifies the right practices for each sector and explores in specific what would the private business provide to achieve successful management in sustainable performance. Therefore, it is recommended that a particular sequence of activities should be followed, starting from data collection and reviewing all possible waste management activities and setting up the required plan for the practical policies taking into consideration the continuous challenges in the Emirate's context. This is to be followed by formulation, implementation and monitoring of the action plan in view of the challenges pertinent to the Emirate.

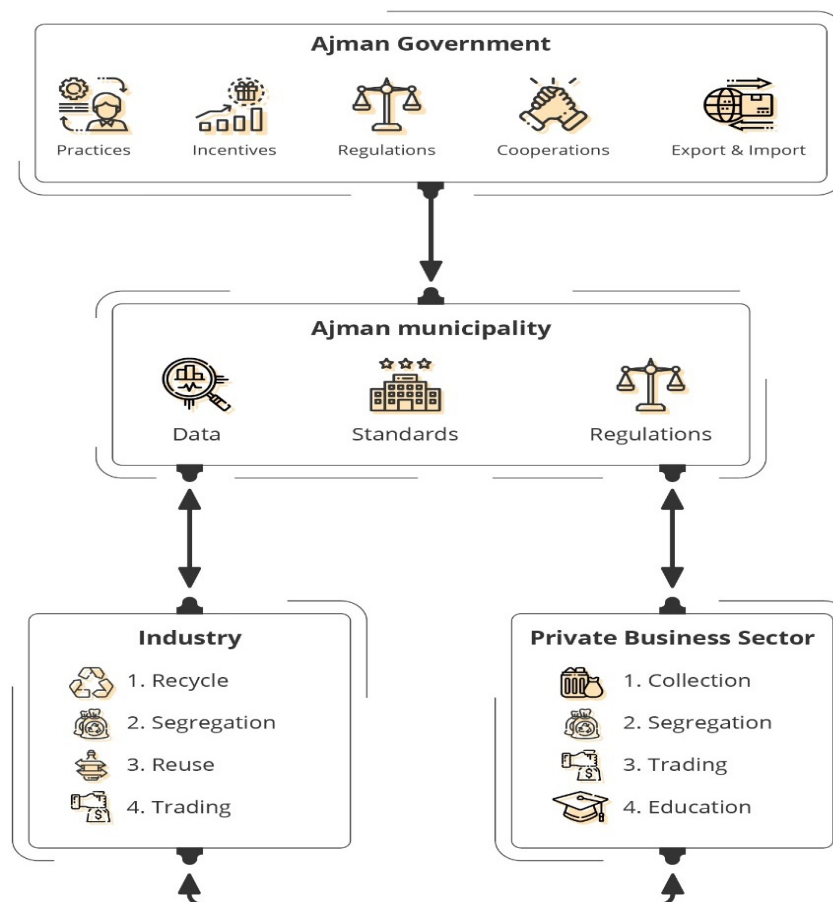


Figure 8 Model for Waste Management Sustainability
Source: Author

Continuous evaluation of the process should have the primary goal of the environmental benefits and risks assuring that the business sector is aware of the regulations are followed and performed by setting third part auditions.

However, the subject of sustainable waste management must be first explored on the grounds of the tri-dimensional framework of economic, social, and ecological sustainability [19]. The author is, therefore, suggesting a conceptual framework presented in Figure 9, which constitute of mixed methodology of qualitative and quantitative research work.

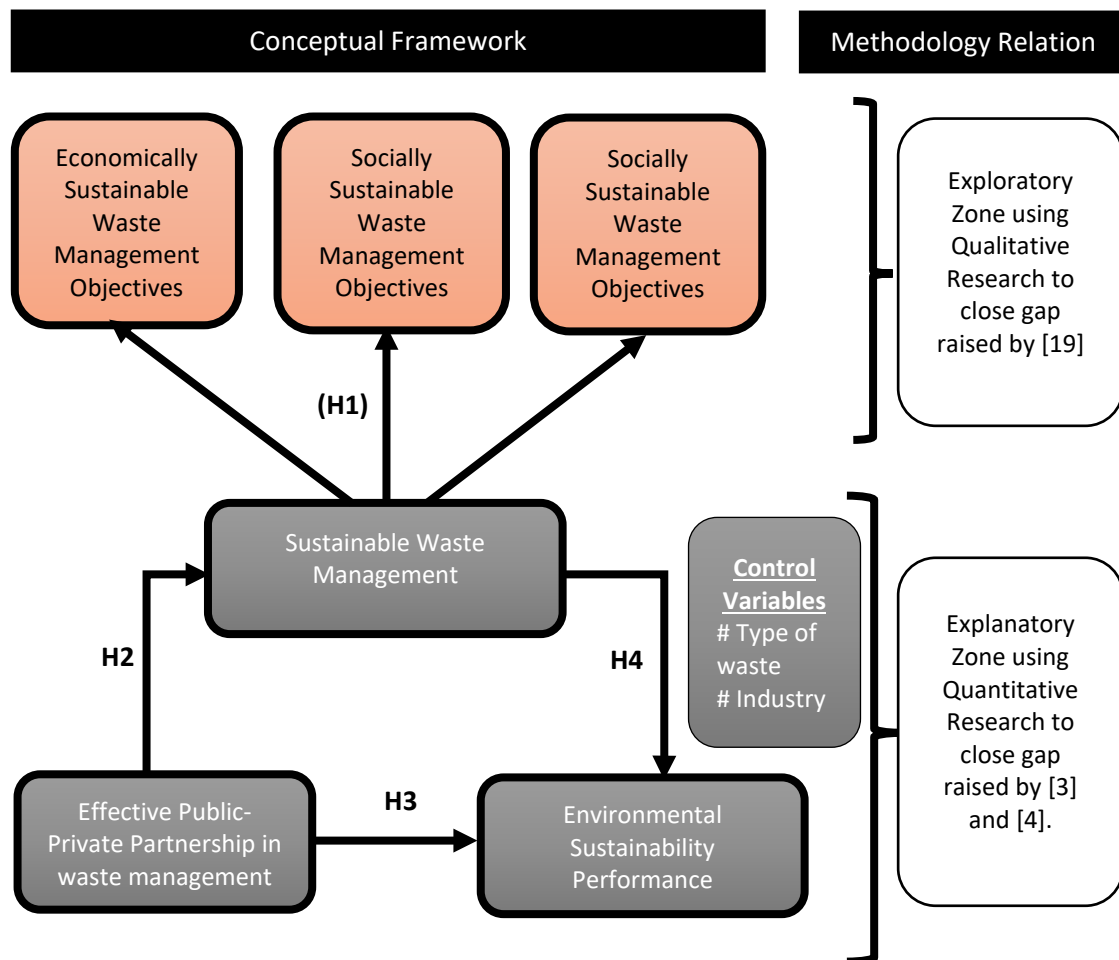


Figure 9 Conceptual framework and methodology relation (H is Hypothesis)
Source: Author

Strategic Risks for Business - Waste Management

Strategic risks have been identified by the Municipality [12], that may affect the vision and objectives that have been set up between the period 2017-2018. Some of the essential risks related to the waste management are as follows:

- The administrative and financial independence of the department is hindering the speed of its adoption to cope with the urban development witnessed by the world, and hindering the speed of its completion of the basic projects in the Emirate and development projects due to the limited annual budgets.
- Pollution from facilities outside the Emirate's borders cannot be controlled.

- Lack of technical staff to control the facilities producing liquid waste
- Lack of a market for companies deal with waste management for specialised purposes in the Emirate.
- Lack of adequate waste sorting and recycling facilities in the Emirate.
- Lack of adequate sorting of wastes from the source and weak culture from the community to adopt waste sorting from the source.
- Lack of markets for some types of recycled materials such as recycled plastic bags.
- Violations of construction work and excavation in the Emirate's reserves without obtaining any approvals from environmental management and development, failure to maintain biodiversity in the Emirate, failure to comply with international agreements.

These risks have been carefully considered by the Municipality and a plan must, therefore, be managed to reduce their impact. A need for a regulated framework is to enhance this action. Empowering the waste business concepts and private organisations could well contribute to achievement for the sustainable waste management.

Positive Environmental Impacts Achieved Through Digitalization Initiatives

One of the advanced practices that recently developed at the Emirate of Ajman is the digital master plan for Ajman 2017-2022 aimed to create a road map to transform the government services as well as their digitally. Five objectives are included for 30 priority government services every 100 days leading to an expected achievement of financial efficiency. For example, Figure 10 shows Indicators of reduction in environmental impact through digitalisation by reducing paper use in 2018 as a positive environmental impacts achieved through digitalisation initiatives [12].

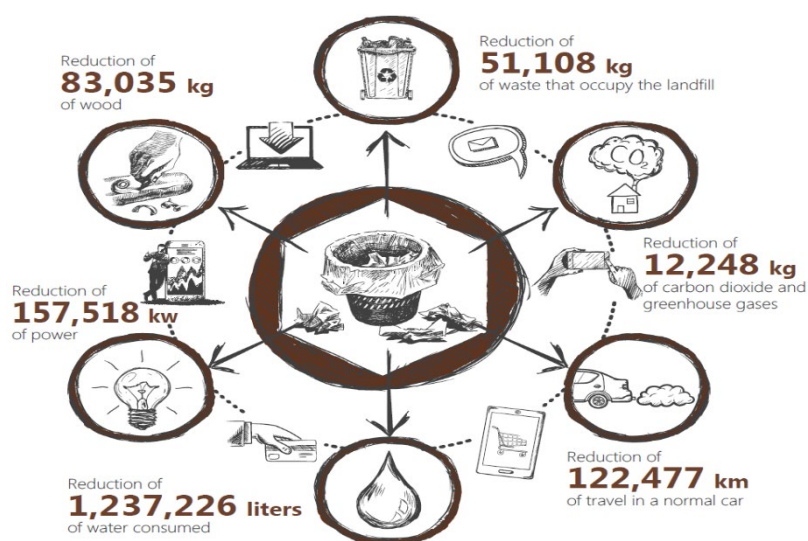


Figure 10 Indicators of reduction in environmental impact through digitalisation by reducing paper use

Business Advantages for Waste Minimisation – Initiatives

Currently approximately 77% of solid waste generated in the UAE is disposed of at landfill facilities with approximately 20% diverted from landfill and approximately 4% is recycled as reported by Ajman Municipality. In specific the Emirate of Ajman is targeting to recycle 75% by 2021 achieving a reduction to 1.5kg/day per capita waste as shown in Figure 11, [7]. A need for different framework of practices to achieve this target. Initiatives such as proper technique and methodology to calculate the national waste indicators, Collecting accurate data about the Municipal Solid Waste (MSW) periodically, develop education and awareness programs and campaigns in order to reduce the waste generation rate and increase the segregation of municipal solid waste at source, and create an integrated system within other municipalities within the UAE to achieve an efficient road map for the initiatives that lead the management framework.

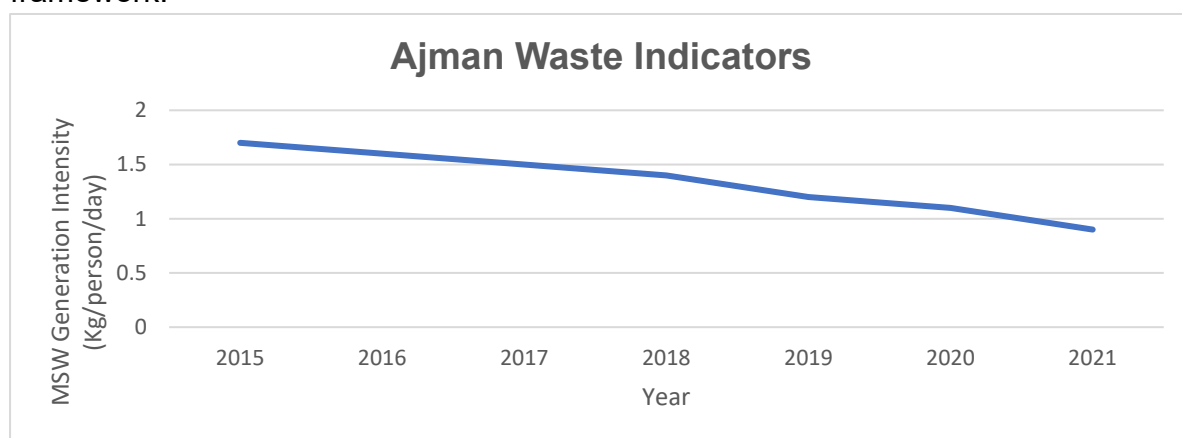


Figure 11 Ajman Municipal Solid Waste Indicators (Produced by author, data from [12])

Waste Treatment Technologies Business Opportunities

The Emirate of Ajman has a total of three Materials Recovery Facility (MRF) sorting facilities. Mixed municipal solid wastes (MSW) arrive at the three facilities where the recyclable materials are removed using a mixture of manual and automated picking and separation methods. The recyclable items that are segregated by the Ajman MRFs include:

- All Kinds of plastic materials
- Paper
- Organic waste
- Metals
- Cardboard

Initiatives to deal with the amount of waste in Ajman has been thought through by the Government. Many aspects are to contain the waste management and the treatment is an essential practice that must be considered within the proposed management framework model. Table 3 shows initial thoughts by the Ajman [12]. Many of these thoughts were considered and implemented with improvements that use latest technologies taking care of disadvantages.

Table 3 Advantages and disadvantages of Treatment Technologies.

Technology	Advantages	Disadvantages
Mechanical Biological Treatment.	Combines MRF sorting with composting, can produce Refuse Derived Fuel.	Low-quality compost, waste may require further treatment in some markets.
Unsorted / Residual Waste Materials Recovery Facility (Dirty MRF).	Cheap to implement, can be used with existing waste collection regimes	Gives poorer quality recyclates than clean MRF.
Energy from Waste (EfW) – Incineration.	Reduces mass disposed greatly, proven technology. Can treat most waste streams	May be unpopular in some markets due to pollution concerns and visual impact.
Fluidised Bed Combustion Technology.	Reduces mass disposed greatly, proven technology. Very low emissions. Can treat most waste streams.	May be unpopular in some markets due to pollution concerns and visual impact. More expensive than EfW above.
Anaerobic Digestion.	Comparatively simple technology. (cf. EfW, etc). Can produce green energy via methane capture. Produces soil enhancer.	Expensive compared with other organic treatments such as composting.
Composting.	Simple technology, cheap to buy. Produces soil enhancer.	Can only treat biodegradable wastes. Needs special facilities (IVC) for managing some pathogen risks.
Materials Recovery Facility (Clean MRF).	Roughly same cost of machinery as dirty MRF. Good quality of materials produced.	Needs dedicated collection, so can be costly to implement.
Pyrolysis & Gasification.	Reduces mass disposed greatly, proven technology. Very low emissions. Can treat most waste streams.	May be unpopular in some markets due to pollution concerns and visual impact. More expensive than other thermal technologies above. Unproven in most markets with chequered past so far economically.
Co-incineration.	Reduces mass disposed greatly, proven technology. Uses existing facilities.	May cause additional pollution due to inconsistencies in the input waste streams. Can cause corrosion in boilers unless combustion chamber modified.

Conclusions

The Emirate of Ajman is the smallest in the UAE. Nevertheless, Ajman is an active Emirate and constitute many industrial, tourist, and other business. Increased population has resulted in a significant increase in the amount of all types of waste which have added challenges to the associated authorities to manage this increase sustainably and to achieve the Emirate sustainable development goals. This paper explores the existence of a lack of waste management correlated with business opportunities policies and practices in the UAE. The growth of three waste streams is shown, which indicates a continuous increase in the amount of waste expected for several years coming despite the use of technological advances and other modern practices. The research discusses the fact that in order for the authorities to achieve their sustainable development goals, and in specific the goals interrelated with the waste management, different factors are introduced and discussed. The proposed factors are to construct an effective Waste-Business interrelation framework model which consists of policies, practices and regulations and modelled in a framework to form the main initiatives for an advanced and effective sustainable waste management at this Emirate. The model is to empower the Waste-Business relationship by converting the practices for waste management in a way that can attract the private and the public sectors to invest. Creating initiatives for business opportunities could well help sustain the waste management process and reduce the associated problem with liquid/solid waste accumulation, resulting in a more favourable impact on the environment. The importance of this study is that it will further benefit the future planning and development of the United Arab Emirates in the waste management and associated business sector.

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