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Approach to Economical Assessment of Municipal waste Recycling systems Approach to environmental Case Study: Fixed Stations of Collect dry waste in Zone-11 in Mashhad City-Iran

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ABSTRACT

The present study was designed to evaluate the economical plan of recycling urban waste, dry waste by fixed stations in zone no. 11 municipalities Mashhad city deals. The used information this study, the data related to volume , revenue and expenses waste collection stations using waste bank in 2012, which is collected by the recycling organization of Mashhad municipality . In this Research in order to economical evaluation waste banks all income, expenses and savings, economic and environmental projects in the region, 11 have been calculated. The results proved the justifiability design collection stations I waste of economic and ecological points of view.

Introduction

Recycling is processes in which valuable substances contained in garbage will be waste separated and collected and are used in prime form or as raw material for new product (Kia Farzad. et al, 2009). Generally in developing countries lack of attention to the issue of waste collection and disposal, uncontrolled urban development, restrictions for public service in large cities, and the inappropriate technologies had and will have many problems, that their obviation is possible only with correct attitude and scientific method and proper management framework.

Management and recycling of solid waste due to reducing the volume and weight of existing garbage and reusing possibility and facilitate the process of collection , disposal and reuse of waste materials into useful form, is very important. (Karim Zadegan et al, 2005).

Recovery operations of garbage usually are done by composting and recycling methods in Iran. According to the existing statistics municipalities organization of the country, in active metropolises like Isfahan, Tabriz, Tehran, Shiraz, Mashhad, Kermanshah regarding garbage recycling 79% of waste is buried , 2% will be recycled and about 19% r converts into compost. In the country of Iran in average the recovery rate is 0.8 %, compost is 7.2 % and burial is 92% that out of this 92%, only 20% of it buried in sanitary and normative way and rest are intermitted in non-hygienic form.(kia Farzad& others, 2010). This issue clearly highlights the lack of attention to the issue of recycling.

While daily increasing the production of recyclable garbage and their disposal into the environment, in addition to squander national wealth of the country is causing the loss of natural resource.

So pay attention to the issue of recycling and efforts to develop and expand this industry in order to reduce the environmental damages caused by the accumulation of solid waste, Provide basic inputs required for various industries and make very necessary as a step towards sustainable economic development. In this direction, the study and analysis of the physical specifications of solid wastes and estimate the economic and environmental costs and benefits arising from the utilization of waste can be help noteworthy in the process of directing to the investments made in this industry.

In fact, the costs that resulted from heterogeneous waste disposal into environment is created in economical and environmental dimensions also the potential earnings calculation which is achievable as result of the reuse of recyclable resources in the waste Can guide policy makers of city and country regarding long term in order to make optimal use of these funds and move towards the goal of sustainable development . On this Basis this research studies the physical analysis of urban waste in Mashhad and Analysis cost - benefit recycling of this waste with approach to environmental recycling of this waste. A number of studies have been undertaken regarding economic assessment of municipal waste recycled in, that some of them are mentioned in the following:

1. Karim Zadegan et al (2005) studied for the economic justification process of municipal waste recycling of Lahijan

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city in 2002. The results of this research show that recycling of paper, glass, plastic and metal can be taken total annual economic value to 127160448 IRR.

2. Kia Farzad. Et al (2010) examined the economic aspects of recycled glass and cardboard of Delijan city garbage Basis Stagecoach began in 2009. Based on this survey results recyclable of these materials each year, saving 11,815 trees, 299.74 GJ of energy and reduce water consumption amounted to 53.55 million liters per year.

3. Amasi and colleagues (2005) in a study, were examined the economic importance of recycling waste of a villages Kashan city in 2002. The results of this research show that recycling of household garbage in rural areas of Kashan will have 3572 Thousand Rrilas benefit monthly, That can be covered a significant part of the cost of rural garbage collection and landfill .

4. Kia Farzad. et al (2009) to assess the economic and environmental aspects of recycling of paper and cardboard from urban garbage in 2007. The results of this research refers to economic and environmnental feasibility of recycling of paper and cardboard waste of Isfan city.

5. Moand &Abedi (2009) in a research studied on the economical valuation of recycling household waste in 20 zone in Tehran in 2006. The results of this research show that recycling of solid urban waste in Tehran in addition to reduce cost about 570milion Rials resulting from the disposal of more than one billion in revenue will also be recovered Income of one milliard Rilas raising of recycling .

6. Dalvand and colleagues (2008) examined the status of recycling waste paper and cardboard from garbage of Isfahan city and did evaluate the economical and environmental aspects of it in 2007.

Based on this survey results in order to achieve optimal recovery of 80% an amount equivalent to Rials 10,144,410,000 will be saved.

7. Kazemi (2012) examined the economic aspects of the separation from origin of, the survey results emphasis on the profitability of the project refers to the separation of origin in Mashhad.

The present study deals to collection dry waste economical evaluation of fixed stations in zone 11 of Mashhad city with the environmental approach Therefore, environmental and economic savings It is expected that the resulting from the dry waste collected by these stations will be examined.

It is expected the results of this research as a tool for future planning of urban systems can be used to recycle the recycling urban waste dried system.

Materials and Methods

The methodology of this study is analytical and documentary. Information used in volume data, revenue and expenses for fixed stations is to collect dry waste in Mashhad – zone 11 during the third quarter of 2012, which is collected by Waste Management organization. Also In order to calculate the environmental savings resulting from implementation of this plan, the amount of savings in energy consumption in the manufacturing sector, using recycled materials as raw materials will be charged at the factory. To achieve this purpose, the results of Morris 'study (1996) has been used. In this study, the minimum and maximum savings in energy consumption resulting recycling 25 types of sherry solids contained in the waste were calculated.

Discussion and conclusions:

One of the methods of separation from origin is to create dried waste transfer stations that were implemented by the city of Mashhad municipal wastes management organization in 2008. The implementation of this method, in addition to encouraging residents to separate waste production , provide the possibility to receive and appropriate use of incorruptible urban waste , and prevent of unsanitary recycling This materials by traditional factors. At present there are three fix dry waste collection stations in this area that according to the waste Management Organization, monthly have of have been received 70 tons of dry residue from the people in 9 months of the 2012 in average.

Figure 1 shows the physical analysis of these residuals. According to graph it can be seen that among collected dry by these stations paper and carton or box have the highest and glass have lowest portion.

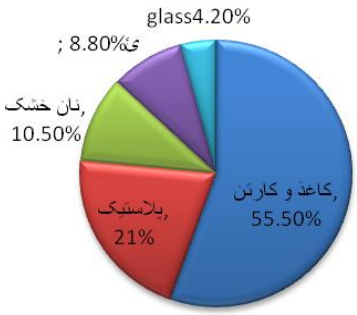

Figure 1. Physical analysis of dry waste collected by the waste bank station zone 11 December 2012

Therefore, can consider the amount of dry waste collected waste by these stations separately as shown in Figure 2.

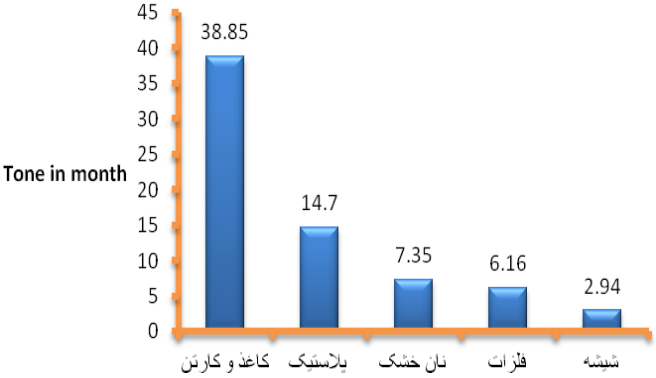

Diagram 2. Medium dry waste collected in the month of separation in kind (third quarter 2012)

The Calculation the cost of dry waste collected by waste bank stations in 2012

The extent of required expenses for collecting dry waste by waste bank stations of zone- 11 is presented breakdown of costs kind in Table 1.

In this table, the amount of the annual expense for station creation considering the useful life of 10 years for made station and bank long-term interest is calculated with rate of 15% by using the following formula:

$$A = P\left[\frac{i(1+i)^n}{(1+i)^n - 1}\right]$$

Where n is useful life, I banking long-term interest rates, p is the initial cost of the station establishment A is for Annual expense of creating station. Regarding computer the average annual cost is calculated by taking the useful life of 5 years. To calculate the yearly first of all the monthly cost by taking into account the average 70 residues was calculated and multiplied by 12 the annual fee has been determined. According to Table 1,

the average waste collected in each year by the station in District 11 has cost of 2291 billion Rials.

Table 1. Average Annual cost of dry waste collected by waste bank stations in 2012

Amount(Million Rials)	Explanation	Expense variety	Row
33.5	Shelter construction, wiring, interior lining, box, power connections, card and shelving	Station creation	**1**
190.8	Computer observer salary, power and phone, worker	Equipment and personnel	**2**
270	Hourly working time of rental cars to transport waste and worker	Transportation	**3**
227	costs for wages and separation of waste& storage	Storage	**4**
84	Per Tone	Loading up to sales location	**5**
6	Purchasing from people	Total cost of waste purchasing from people	1488
7	General total		2293.3

Calculation of gross revenues caused by the dry waste collection stations, waste bank

The calculation results of gross revenue from the sale of dry waste collection fixed stations in kind of waste separately are given in Table 2. This revenue has been obtained by multiplying the average amount of collected dry waste in 2012 in a price per ton of waste.

According to Table 2, waste collected by waste bank stations in average has income of 3168.4 million Rials in a year, of course it should be noted that this income is regardless of insurance, and taxes.

So taking insurance and gross income tax, implementing this plan for Mashhad's people with deducting 17.5% tax and insurance would be equal to 2613.6o million Rials.

In this study, given that the purpose is to calculate of social net income and insurance taxes expenses in economic cycles also again goes back to the people by government and insurance office.

Therefore, the deducting these costs are ignored. It should also be noted that to achieve the exact amount of social value, It is necessary to generate income from secondary products from recycled materials should be considered as gross income of community and all production costs will also be considered in the calculation affair of social benefits. But given that income and expenditure information was not available for manufacturing factories it is in this study, it is ignored.

Table 2. Average annual dry waste collection stations in the zone - 11 by separation in waste kind in 2012

row	Waste kind	The amount collected Annually (tons)	Income (million rials)
1	Paper and Cardboard	466.2	652.7
2	Bread	176.4	705.6
3	Plastic	88.2	308.7
4	Metals	73.92	1478.4
5	Glass	35.28	23
6	Total	840	3168.4
7	Insurance and Taxes Cost,		554.5
8	Gross Income with deduction of tax and insurance		2613.9

Calculate the Economical and environmental Gains (social revenues) due to the implementation of fixed stations and waste collection in zone- 11

In order to calculate the amount of saving in energy the results of the Morris's study (1996) is used.

In this study, the minimum and maximum energy savings of 25 separate recyclable materials in municipal waste is calculated. In this research, the required energy to extract, process and transport of primary and secondary materials needed to produce a product with the cost of heating and lighting of factory has been considered in computation . Considering that energy usage different depends on material producing and quality and type of equipment available in plant. Therefore, the minimum and maximum energy savings per kilogram of any kind of recycled materials per kilo joule has been calculated.

Also in calculation of the saved energy resulting in the recycling of paper, due to entering Save of energy caused by the lack of trees cutting resulting of paper recycled , the calculated energy level is above estimated surface. The calculated results of saved energy in recycling outcome per kg (Tone) of dry residue in kind of waste in research by R. Morris 'study is given in Table 1.

In this table, the amount of energy saved by recycling per one ton of material is calculated based on result of Morris 'research.

Table 3. The amount of energy savings as a result of dry waste recycling in Morris 'Research (1996)

Type of material	**Minimum energy saving material (J / kg)**	**maximum energy efficiency (mJ / kg)**	**minimum energy efficiency (GJ / ton)**	**Maximum Energy Saving (GJ / ton)**
Paper and cardboard	18863	30264	18.9	30.3
Plastic	59934	87877	59.9	87.9
Glass	907	4209	35.2	64.2
Metals	35150	64155	0.9	4.2

Source: Morris (1996) and researcher computing.

Table 4 shows the results of energy saving materials recycling stations, waste bank in 11th zone of Mashhad city in 2012. The information in this table are obtained based on data contained in table 3 and the annual amount of waste collected in Table 2. Energy average column has been calculated through the averaged of the minimum and maximum energy saving columns is calculated.

Also in calculating the economic value considering that each liter of fuel oil produces 0.036 GJ energy in average[1]. The energy savings amount from recycling each material has been converted by dividing the average energy savings to this number has to saving furnace oil equivalent and the economic value of saving energy consumption is calculated by multiplying the amount of fuel oil savings in the cost per liter (2,000 Rials).

The results of this research show that with recycling 466 tons of paper annually in the zone-11by fixed stations of collecting dry waste annually 314 thousand liters of fuel oil will be saved and base on this the annual amount of 628 million Rials will be saved. Also regarding plastics, metals and glass, respectively 36, 203 and 5 million Rials savings will take placed in each year.

Also, considering funeral costs equal to 200 Rials per kg of these wastes in addition to the environmental cost annually, 168 million Rials in result of lack of landfill these materials will be saved.

Table 4 - savings as a result of environmental recycling stations, waste bank by zone 11

Row	Income from savings in recycling	Save Energy (GJ / ton)			Consumption Equivalent of fuel oil (liter 1000)	Economic value (million rials)[3]
		Minimum	Maximum	Average		
1	Paper and cardboard	8794	14109	11452	314	628
2	Plastic	5286	7751	6518	181	362
3	Metals	2598	4742	3670	101	203
4	Glass	32	148	90	2	5
5	Save in trees for paper production (trees)	7925.4				
	The total amount of savings					1199
6	(Gains due to non-disposal of dry waste recycled (RLS)					168

Table 5 - Calculation of economic benefits arising from the recycling of waste by waste bank stations of zone- in 2012

Row	Expense or income	Amount (million rials)
1	The total cost of recycling	2293.3
2	Total revenue recycling	3168.4
3	The net profit (earnings excluding environmental gains)	875.2
4	Net profit of contractors (excluding revenues Environmental gains)	205.6
5	Savings resulting from the lack of landfill	168
6	The net cost savings with regard to burial	1043.2
7	Gains resulting from reduced energy consumption	1199
8	The net profit (with counting Energy gain)	2242.2

And this expense is apart from environmental savings that as result will cause in reducing the environmental pollution due to disposal of this material. In addition of this by 466 tons of recycled paper annually by these stations will stop cutting down trees 7925[1].

It should be noted that land contamination cost resulting in material disposal, Amount of savings in raw materials, resulting of using recycled materials as required input for factories and the extent of savings in water consumption is not considered in this study.

1. Heat energy equal to 8680 kcal per liter of fuel oil equivalent that can be calculated as follows
8680X1000X4.2=36456000 which is equivalent to 0.036 GJ.
2. In average per ton of waste recycled, 17 trees will prevent the cut(Farad Kia, et al 2009).
3. Each dollar$ is equal to 25400 Iranian Rials.

Calculate the economical and environmental benefits resulting from the dry waste recycling stations, waste bank by Zone- 11

Calculation of economical recycling arising from the recycling of waste by waste bank stations are given in Table 5, According to this table, the people's net profit regardless of environmental revenues is equal to 875.2 million Rials and with counting the environmental gains the people's social benefits would be equal to 2242.2 million Rilas that is substantial amount.

Conclusion and Recommendations:

Present Research has studied the assessing of economic and environmental recycle municipal waste, based on dry waste collection plan fixed stations in zone-11 in Mashhad city. The results of this study points on the profitability of this project implication in terms of both economic and environmental aspects. According to the results of this survey, the following recommendations have been provided to improve the matter of planning and management of urban Residues:

1. Today one of the issues discussed in the field of urban development is sustainable and environmental protection, and limited resources available with human. Therefore it is suggested the matter of environmental costs and benefits of the project be considered at time of studying the justifiably all urban plans. In this study, the economical gains resulting from energy consumption reduction are only studied, while the recycling of urban waste also include reduce environmental pollution caused by dumping, air pollution, conserve water and other resources. It is therefore necessary to be given to these issues in a broader research.
2. It is Suggested a research project conducted in Mashhad, environmental and economical benefits resulting from the recovery plan implementation in various recycling system separately like to receive the garbage at houses 'door ,waste banks stations ,,,,,,are compared with each other and strengths and weaknesses of each are examined.
3. Given the importance of recycling in urban development and reduce environmental pollution and gain resources, It is necessary with training citizens in many ways like Extensive publicity in the mass media, print and distribute of small book let in the city and,,,,,,, and familiar and People with the benefits of the plan and urged them to cooperate in its advantage Implementation.

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