

Contribution to National Economy of Waste Paper Recycling (Example of Turkey's Hotels)



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Abstract

Waste paper is any kind of paper, which cardboard and cardboard were completed the function in any use area, is discarded. However, recycling of paper waste paper is one of the best options for sustainable development and zero waste targets. Because waste paper recycling supplies significant contributions to the sustainability of forestry resources, to energy saving efforts, to reduction of environmental pollution levels and to effective utilization of raw materials. The economic contribution of waste paper recycling can be much greater if these wastes are collected at the source. Economic realization of this contribution can only be achieved through knowledge of the qualitative and quantitative properties of the recycled waste paper. Therefore, it becomes important to identify the sectors that consume relatively higher amount of paper as a final product, to raise their awareness and to provide solutions for on-source-separation practices in such sectors. It is widely known that the hotels consume larger amounts of paper compared to other consumer units. Thanks to its historical, economic, political, cultural and scientific characteristics, Turkey is one of the countries that receive the highest number of tourists. Turkey was chosen as the study area for the present study. The present study aims to calculate value of economic benefit created by waste papers collected by application of on-source-separation process in Turkey's hotels.

Keywords: Economic contribution; Waste paper; Turkey's hotels

Introduction

In conventional understanding of development, rapid industrialization would bring rapid economic growth. However, this simple rule brings many complications in practice such as increase in environmental disasters. For this reason, starting from early 1960s alternative development approaches have been explored especially in developed countries TUBITAK [1], Doganer Gonel [2]. At the end of 30 years of search for a solution, the concept of sustainable development was introduced as oppose to the conventional development approaches Yikmaz [3].

Differing from conventional development approach, the alternative development approaches focus on providing sustainability for three aspects of social welfare (i.e. economic, social and environmental aspects). However, targets of these three aspects may sometimes contravene. For instance, use/consumption of natural resources and generation of waste is required for economic sustainability while such activities expose environmental sustainability to the risks. Nonetheless, significant efforts have been made to solve the problems created by contradicting targets. One of such efforts involves "recovering recyclable wastes as secondary raw materials for economic use" as a means of preventing environmental pollution and excessive use of natural resources.

Mankind is the species that generates the highest amount of waste in the Earth. According to estimations, mankind generates an average of 1,15 trillion kg of waste per year. Previous practices of unsanitary disposal and incineration of such waste as it was accepted as mere garbage increased the environmental pollution. For this reason, waste management practices were started to be implemented so to prevent environmental pollution. These practices stipulates sanitary landfills, composting, re-use, recycled and recovery methods which ensure re-introduction of half of the wastes into the economy.

Given the advantages created by recovery of recyclable waste such as creation of job opportunities, effective use of natural resources, creation of economic added value and provision of environmental improvement the recycling sector has been a fruitful effort for mankind. In this sector there are many stages such as minimization of waste, source-separation of waste as well as storage, transportation, recovery, recycling and disposal of waste. As it can be understood from ongoing explanations, recycling is actually an important environmental protection policy. Thanks to this policy the waste shall no longer be categorized as an environmental hazard and becomes an economic value which serves as basis for sustainable development. For this reason, the "National Recycling Strategy

Document and Action Plan, 2014-2017” was prepared in Turkey to improve the efficiency of recycling sector in the country (TR Ministry of Science, Industry and Technology [4]. Mrayyan and Hamdi [5], and Yilmaz and Bozkurt [6] reports that while the developing countries still go on with the debates concerning disposal of the waste, the developed countries already move to advanced practices such as composting and recycling.

The objective of the present study is to calculate the monetary value of the source-separated waste papers generated by hotels in Turkey as the hotels are known to be areas where the paper and derivative products are consumed compared other consumer units. It is considered that once learning about the economic value of the waste paper, the operators of these hotels will have increased sensibility towards source-separation practices.

Benefits of Recycling Waste Paper

Paper is a material the consumption rate of which is acknowledged as an indicator for development. The base material of paper is cellulose. If the cellulose is obtained solely from raw fibers, plant sources, such as trees and other kinds of perennial and annual plants are consumed. For centuries forests, as well as other ecosystems wherein such plant sources are found have been exploited as sources for raw fibers to produce paper. Such exploitation, however, put the sustainability of natural resources in danger. Nonetheless, cellulose derived from waste paper can also be used for paper production which in fact was taken in practice thus turning the waste papers into a valuable raw material for national economies.

Consumption habits, population growth and lifestyles as well as standards of living affect the composition of solid waste generated by the population. Typically 20% of total weight and 50% of total volume of all solid waste is constituted by packaging waste and paper takes an important proportion of all packaging waste. In fact, source-separation of packaging waste essentially falls under the responsibility of municipalities. However, the costs of such efforts must be paid by the generators

of such waste according to the principle of “polluter pays”. For this reason, the persons/organizations that use paper and thus generate waste must have increased awareness for recycling of waste paper Armagan et al. [7].

Whole of the waste paper generated cannot be recycled for a certain part of it is collected in an inappropriate way and/or taken into recycling process after its decay time (between 3 months and 5 years) is expired. It is also known that the waste paper properly collected and introduced to recycling process in due time loss 25-20% of its fiber content during recycling processes. Nonetheless, despite certain losses during recycling of waste paper, around 80-85% can be regained.

Yorulmaz [8] and Yildizbas [9] refers to the “Paper Production off Waste Paper, Industrial Profile, 2010 Report” prepared by the Ministry of Science, Technology and Industry and lists the benefits obtained through production of paper out of 1 ton of waste paper:

- a. 24-28 grown trees are saved (not cut-down)
- b. Dispersion of 36 tons of CO₂ to atmosphere is prevented
- c. 4100 kWh electric power is saved
- d. Dispersion of 267 kg pollutant gases to atmosphere is prevented,
- e. 1750 liters of fuel oil is saved,
- f. 3 - 4 m³ of waste landfill area is saved,
- g. Destruction of 85 m² of forestry area is prevented,
- h. 38,8 tons of water is saved,
- i. Also, dependence on foreign sources is reduced given absence of need for paper import,
- j. On the other hand, collectors of waste paper generate revenues over scrap paper.

Description of Study Area

The study area is constituted by hotels in Turkey (Figure 1).

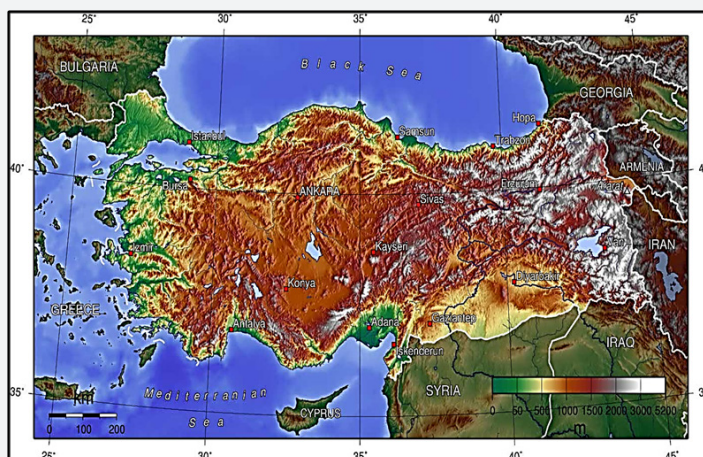


Figure 1: Study area is Turkey.

These hotels have a total accommodation capacity of 915.000 beds Certified by the Ministry of Culture and Tourism. When the uncertified facilities are considered, the total accommodation capacity increases to 950.000 beds. There are 27.000 hotels in Turkey and around half of these hotels are 5 stars. Amounts of waste paper collected from hotels in Turkey are shown in (Table 1) below Turizm Ajansi [10] (Table 1).

Table 1: Amounts of waste papers collected from hotels in Turkey in the year 2016.

Hotel	Percentage	Bed	Waste Paper
		Number	Ton
5 stars	45,6	433.200	4.332
4 stars	30,4	288.800	2.888
3 stars	13,5	128.250	1.282,5
Others	10,5	99.750	997,5
Total	100	950.000	9.500

Material and Method

The material used for the present study is domestic and foreign literature on waste paper recycling. The present study was carried out as a case analysis to determine the economic contribution of recyclable waste paper generated by hotels in Turkey in five steps:

a. Benefits of recycling one ton of recyclable waste paper (Y_i) based on the information obtained from Yorulmaz [8] and Ozturk [11] and Yildizbas [9]:

- i. Y_1 : Approximately 26 trees are kept in the nature,
- ii. Y_2 : 4.100 Kwh of electric power is saved,
- iii. Y_3 : 38,8 tons of water is saved,
- iv. Y_4 : 1.750 liters of fuel oil is saved,
- v. Y_5 : Dispersion of 267 kg of waste gas to atmosphere is prevented,
- vi. Y_6 : Dispersion of 36 tons of CO_2 to atmosphere is prevented
- vii. Y_7 : 4m² of waste landfill area is saved
- viii. Y_8 : Scrap paper is a source of revenue
- ix. Y_9 : Destruction of 85 m² of forestry area will be prevented.

b. Monetary value (X_i) of 9 different types of benefits listed above was estimated or calculated as of the year 2016.

c. The amount of recyclable waste paper that can be collected from the hotels in Turkey was estimated. The estimation was based on the information stated in a study by Banar [12] that "A hotel with 100 rooms can collect up to 50 thousand packaging boxes thus contributing 1 tons of waste paper to the economy". Hence it was assumed that a hotel room can generate 0,01 tons of

recyclable waste paper per year. Therefore the amount of waste paper that can be generated by hotels in Turkey was calculated by multiplication of the number of rooms with the value 0,01 ton/year.

d. The value of different types of benefits of recycling waste paper was calculated by multiplication of the amounts given in the first item for different types of benefits with the total amount of waste paper to be generated by hotels in Turkey.

e. Total economic value (TEV) of the contributions by hotels in Turkey in waste paper recycling is calculated by application of the following formula:

$$TEV = \sum_{i=1}^9 X_i \times Y_i$$

Whereas X_i indicates the amount of the benefit i , Y_i indicates the unit economic value of the benefit i .

Results and Discussion

Unit values of the benefits created by recycling waste paper of hotels in Turkey for the year 2016 have been determined as follows:

Y_1 : Average value of a coniferous pine tree that can be used for paper production is 186,13 Turkish Liras (TRY) 61,57 United States Dollar (\$) (Ministry of Forests and Water Affairs [13].

Y_2 : Price of electricity is 0,34TRY (0,113\$) per kWh (Turkish Electricity Distribution Corporation (TEDAS) 2016 electricity tariff) TEDAS [14].

Y_3 : Price of water is 9,32TRY (3,08\$) per ton (Istanbul Water and Sewage Administration (ISKI) [15].

Y_4 : Price of fuel oil is 2,70TRY (0,89\$) per liter Energy World Magazine [16].

Y_5 : Cost of prevention of atmospheric dispersion of CO_2 is 194,50 TRY(64,34\$) per ton (T. Ministry of Energy and Natural Resources [17], Central Bank of Turkey [18].

Y_6 : Cost of prevention of atmospheric dispersion of waste gases is 194,50TRY (64,34\$) per ton which is accepted equal to the cost of prevention of atmospheric dispersion of CO_2 (TR Ministry of Energy and Natural Resources [17].

Y_7 : Cost of waste landfill area is 14,80TRY(4,90\$) per m³ Gullu [19] Central Bank of Turkey [18].

Y_8 : Waste paper scrap value is 324,15TRY(107,23\$) per ton Ayhan Metal Recycling Industry Limited Company [20].

Y_9 : Annual gain of pine forests is 0,42TRY(0,14\$) per m² Bekiroglu [21].

As it can be seen on the (Table 1) above, for the year 2016, a total amount of 9.500 tons of waste paper can be obtained from the hotels in Turkey. Amounts of the benefits of recycling

recyclable waste paper obtained from hotels in Turkey are given in the (Table 2).

Table 2: Amounts of the benefits of recycling recyclable waste paper obtained from hotels in Turkey.

Hotels	Waste Paper (Ton)	Tree (Number)	Electricity (kWh)	Water (Ton)	Fuel oil (Liter)	Waste gases (Ton)	CO2 (Ton)	Landfill area (m2)	Forestry area (m2)
5 stars	4.332	112.632	17.761.200	168.082	7.581.000	1.156.644	155.952	17.328	368.220
4 stars	2.888	75.088	11.840.800	112.054	5.054.000	771.096	103.968	11.552	245.480
3 stars	1.283	33.345	5.258.250	49.761	2.244.375	342.428	46.170	5.130	109.013
Others	998	25.935	4.089.750	38.703	1.745.625	266.333	35.910	3.990	84.788
Total	9.500	247.000	38.950.000	368.600	16.625.000	2.536.500	342.000	38.000	807.500

Economic values of the benefits of recycling waste papers from hotels in Turkey are given in the (Table 3). Distribution

of economic benefits of hotels by contributing to waste paper recycling in Turkey is given in the (Table 3).

Table 3: Economic values (\$) of the benefits of recycling waste papers from hotels in Turkey.

Monetary value	5 stars hotels	4 stars hotels	3 stars hotels	Others	Total
Y ₁ :Trees	6.934.897	4.623.265	2.053.095	1.596.851	15.208.108
Y ₂ :Electricity	1.997.621	1.331.747	591.401	459.978	4.380.748
Y ₃ :Water	518.201	345.467	153.415	119.323	1.136.405
Y ₄ :Fuel Oil	6.770.989	4.513.993	2.004.569	1.559.109	14.848.660
Y ₅ :CO ₂	10.033.961	6.689.307	2.970.581	2.310.452	22.004.300
Y ₆ :Waste gases	74.418.544	49.612.363	22.031.806	17.135.849	163.198.561
Y ₇ :Landfill area	84.834	56.556	25.115	19.534	186.040
Y ₈ :Scrap paper	464.511	309.674	137.520	106.960	1.018.665
Y ₉ :Forestry area	51.159	34.106	15.146	11.780	112.190
Total (\$)	101.274.717	67.516.478	29.982.647	23.319.836	222.093.678

Table 3 shows that recycling one ton of waste paper provides economic benefits worth 222.093.678 \$. It should be noted that the present study did not consider the totality of economic benefits of recycling such as employment created in the recycling businesses or the market value of the products to be created through recycling. For this reason, it is safe to say that the above calculated benefits are just the tip of the iceberg.

Recyclable paper waste can be re-introduced to economy 12 times over. For this reason, considering that the waste paper generate by the hotels in Turkey can be submitted for recycling for minimum 6 times, the total sum of economic benefits of this practice can be calculated as 1.332.562.065 \$. The proportion of waste papers used in paper production is around 50% in Turkey for the year 2016. The rate of recycling is on an upwards trend and it is aimed to increase it up to 70% Cevik [22]. For this reason, once the waste papers generated by the hotels in Turkey are introduced to the paper production, an economic benefit worth of 2.265.355.510 \$ will be obtained.

Cevik [22] reports that Turkey recorded a total sum around 3.8 Billion USD for paper exports every year. Accordingly, with a 70% recycling rate, hotels of Turkey can provide significant contributions to the national economy to be specific, up to 60% of total paper exports of Turkey. On the other hand, given the

problems concerning supply of raw material and inputs for paper production in Turkey, re-introduction of recyclable papers into the economy would serve as a good means to reduce foreign dependency and the environmental pollution and to support the sustainability of forests.

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