



Cost benefit analysis of the recycling process with regard of the environmental protection and financial benefits for organizations

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Abstract

Organizations that have implemented the system for environmental protection according to international standard ISO 14001, on the one hand reduce the harmful impact on the environment or the same amount to within an acceptable, while other organizations are facing a real problem for the effective monitoring of impact on the environment. The purpose of this paper is to show how that can directly increase the efficiency of system implemented through a recycling process that greatly reduces the amount of drawback, but also brings financial benefits to organizations. Recycling process introduced by the beginning of the implemented system for environmental protection increases the efficiency of the same, reduces waste, increases profits and reduces the direct impact of the industrial system on the environment.

Keywords: environmental protection, ISO 14001, recycling, cost benefit analysis

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1. INTRODUCTION

The dynamics of market changes is a variable that is changing constantly. Technological development and short lifecycle of the products produce large amounts of waste. Waste in any form and shape, affects negatively on the environment. That is the reason why most organizations apply technologies and processes combined with international standards for environmental protection ISO 14001, significantly reduced the amount of waste on one hand, and bring enormous financial benefits to organizations on the other hand.

Undoubtedly financial gain is one of the key priorities of the organizational operations of each business entity, regardless of size, organizational structure and activity. However the financial result is closely connected with the production and formation of waste. Most organizations are not sufficiently aware of the size of waste that they are producing, negative environmental impact and economic losses they suffered during the manufacturing process. Only an effective management system elements that affect the environment can at the same time significantly reduce the amount of waste and bring financial benefit to the organization through the application of closed cycle recycling, where the waste is converted into useful input that brings financial benefit.

2. REVIEWING THE RECYCLING PROCESS

When the organizational performance is reviewed in terms of environmental protection, many organizations apply the model of reducing waste through an active system for financial gain. In this direction the process of recycling completely meets the defined program to reduce pollution and increase the financial benefit.

The concept of recycling is based on the new generally accepted methods that reduce energy use in the production process, reduce production of harmful by-products and reduce the amount of waste produced during the manufacturing process. Indeed waste that is output from a process using this methodology is a useful input to another process. The purpose of this methodology is primarily to satisfy human needs without endangering and damaging impact on the environment. In fact so-called "Clean production" is a preventive approach whose main purpose is to prevent or reduce the quantity of waste and inefficient use of energy and resources in business input would be a financial loss. In order to achieve this strategic goal the organizations we have to change the organizational mode of action and adopt new technologies and techniques. Basically the process of recycling can be defined as a process that is completely directed towards:

- Reduce the amount of waste produced
- Utilization of waste into more production cycles
- Efficient use of energy resources
- Reduce the amount of waste, reduced prices of final product and increase of the profit.

Recycling process is applicable to a range of waste ranging from plastic, cardboard, paper, metal, etc. However in terms of financial benefit and cost effectiveness, the usage of the waste is one of the critical processes. The amount of garbage in Republic Macedonia is enormous, but despite the efforts of local utilities and other private businesses, accurate records and systematic approach to dealing with this waste does not exist. Although efforts to recycle and economic benefit from this garbage in recent years are remarkable higher level, still requires further efforts in this direction. If we consider management system and waste, whose amount is increasing daily due to the

irreversible PET bottles, cans or glass, we can freely say that there is lack of effective management system in this direction. In addition is given figurative display of the estimated amount of packing waste.

Table 1. Waste produced per year

Waste type	Tones produced per year
Glass	90.000
PET plastics	88.000
Paper	115.000
Composites	17.300
Aluminums	5.200
Other	19.000
Total	334.500

Analyzing the tabular data, we can freely say that the amount of plastic is increasing, which inevitably leads to the conclusion that PET waste is the most used waste in recycling. Certainly the financial indicators are in favor of this conclusion, namely the production process of PET bottles 80% of a product, while 20% waste.



Figure 1 Recycling cycle

The process of recycling of PET bottles can be divided into two main processes:

- Waste collection, sorting, baling and selling the balled waste
- Processing the level of PET granules

Processing of PET waste includes the following phases:

- Un balling the balled waste
- Sorting by type and colour
- Grinding with water mill
- Process of purification of PET packaging with water and detergent
- Additional drying
- Heat treatment to PET granulate

Since the process of processing is high expensive process, unlike the first one which is far simpler process that does not require large financial investments. In addition it's shown the survey in this direction.

COST-BENEFIT ANALYSIS

Many of the organizations that use the baling process have set their own containers to carry out refuse collection. After the collection is accessed the process of selection by type and color, and then approaches the baling and selling well-designed bolts.

In order to make cost-benefit analysis there is tabular presentation of basic parameters in urban area with 100,000 people, which was the target of research.

Table 2. Parameters considered in the research

Parameters	Basic information
Weight of single bottle from 1500 ml	50 grams
Container parameters	1,5 m ³ /20 kg
Daily consumption	1 bottle / 50 g on daily base per inhabitant

Daily statistics show that in the region of 100,000 inhabitants on a daily basis, they generate 100,000 bottles or 5,000 kg waste. If we consider that a container for collecting waste has a capacity of 20kg the total amount can fill 250 containers. Certainly these are ideal numbers. Field data show that the optimal conditions the amount of waste is about 60% or 3,000 kg on a daily basis.

On the other hand if we consider statistical data on the recycling of waste in Italy as a country that is far advanced from Macedonia, where recycling is brought to a level 80% of total waste, then the data in Macedonia might easily be reduced pessimistic, or 40% recycling, which would mean a net weight 2000 kg per day. This data information's are taken into account in cost-benefit analysis. In terms of economic viability taken into consideration and purchase price of balled waste, respectively separated by type and color that varies from 110 to 240 euro/1000 kg depending on the type and color. Given that the analysis was accessed with pessimistic variant in the calculation and taken into account the minimum purchase price of 110 euro's per 1000 kg or 0.11 euro's per kilogram.

In addition to the analysis, it's given data for profit organizations area of 100,000 citizens reviewed the pessimistic variant.

Table 3. Profit information

	Calculation	Profit in Euros
Daily	2000 kg X 0.11 euro/kg	220
Monthly	2000 kg X 0.11 euro/kg X 30	6600
Year	2000 kg X 0.11 euro/kg X 365	79200

Taking in consideration that PET packaging is increasingly used, and the process of recycling is increasingly being exploited in future profit in organizations will grow. Still have to conclude that the total profits must be reinvested in containers to new locations that produce increased amounts of recycled waste, which directly affects the reduction of total amounts of waste that adversely affect the environment and increased economic benefit.

FUTURE DIRECTIONS FOR RESEARCH

The survey results were presented by recycling waste in the pessimistic variant, or 40% recycling of waste produced overall. The profit was taken with the assumption that there is coverage of the area with the necessary containers and secured the necessary resources and technology for smooth recycling. However parameters that can still be considered are the following: coverage

and representation of containers, expanding the analysis and consideration of the total cost necessary, review the process from an optimistic perspective, guidance for process improvement, cost-benefit analysis and the ability to process waste.

CONCLUSION

Every single organization on the earth seeks to achieve economic benefit and clear market positioning. However if the organization is reviewed in terms of business models, active application of standards for environmental protection, we can conclude that the process of recycling is worthwhile. If the PET packaging is considered in terms of decompose, the conclude is that the process of degradation can be up to 600 years depending on exposure to sunlight and synthetic material that is assembled. Therefore the process of recycling before the PET packaging and how in favour of the active policy for reduced pollution above the soil, increased economic benefits for organizations, the reduced cost of raw materials and reduced cost of the final product.

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