

# Introducing Effective and Efficient Economics Tools in Urban Waste Management

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## Abstract

Recycling industry as key cycle in waste management chain has significant role in keeping national capitals to prevent from wasting resources and environmental pollution that its efficiency and effectiveness depends on participations of all society levels and responsible governmental administrations. Studies have shown that in waste management of Tehran city, necessary infrastructures and context should be provided besides training and culturing local people and guilds. Economics tools can have important role in improving waste management condition and proper implementation. Among known sufficient tools, taxes, charges, fine systems, and making market are the most important common methods in waste management.

**Keywords:** urban waste management, recycling, economics tools, deposit and bonus system, environmental protection

## 1. Introduction

Today, extensively sustainability has been used for global description that human and natural systems can continue living together to the fat future. If pollution flows reduce, waste recycling is checked intensively, development sustainability landscape will be certainly more promising and each of this action will lead to sustainability. Recent decades experiences have shown that simultaneously with technical progresses and evolutions, finding replacing resources, increasing target price of goods which make pollutions increase optimization and sustainability, so need to make motivation to be satisfied with polluting technologies or processes and facing with healthy technologies and non-polluting technologies is so important. Sustainability means increasing annually amenity chronically and optimization means to maximize economics growth in a way present value. The conception of present value considers amenity level increase rate in future, because according to what happens in future, it has less value in the present time.

Environmental issues is originated by poverty, population changes, ruining environment, and reducing access to healthy food and fast developing that it moves in sinus movement to disaster, and ruining process increases exponentially (Tiller and Tiller Aid, 2009). Accordingly, strategy of reducing pollution is replaced by strategy of removing pollutions in origin (Pepras and Waford 1998, Pater and Iyuns, 2005).

One of today challenges in urban areas such as Tehran city is management and removing wastes principally. Besides, recruiting a vast volume of environment, wastes are an important resource in emission of air, soil, and water pollutions and endanger quality of environment, human health and amenity. The population which played an important role in rural by the least harvest of resources and bringing back a lot part of producing wastes to nature cycle in producing food products with the least wastes. Today, by migrating to urban areas and changing consumption pattern it has changed into one of waste and garbage producers in a way that in 2002 movement toward sustainable producing and consumption, reducing pollution and waste was emphasized and focused in Johannesburg and preference was for reducing garbage, recycling and reusing them and removing them in the correct way.

According to reported statistics, in metropolises each person produces 800 to 900 gr garbage in average that 400

to 600 liter latex from each tone waste or garbage. About 50,000 tone garbage is produced daily in state that more than 75% is from urban areas and 25% from rural areas. In addition, in Tehran metropolis 7000 tone home garbage and 70 tone hospitals garbage is produced daily that cost of gathering garbage and cleaning city is about 1500 billion Rials annually.

Exploring urban wastes which transferred to burning centers shows that in spite of all alerts in this field using reproducible materials and recycling, still irreproducible materials such as plastic one on oil basis are used more than environmental friendly materials. Moreover, in wastes in burning places, some evidences seen which have valuable materials in recycling industry.

One of important reasons in occurrence this problem is not having principally and precise planning in field of calculated target price of consuming goods and not attending to economics value of materials in cycle. When a good is priced, just economics aspects of goods such as calculated target price of raw materials, process and producing costs, services, human force, insurance, and tax are considered, while based on environmental management point of view in order to prevent from irregular consumption and reduce natural resources damage it is needed to focus on life cycle and consider target price of good, costs related to natural resources, environmental effects in producing time and after it, and removing costs. Therefore, it is reasonable, goods with high costs in removing or intensive environmental effect have higher price.

On the other hand, in order to explore and calculate real price of waste, proper and applicable economics tools have been identified, but have been used less in economics valuing of waste goods.

As environmental economics and green accounting has important and great role in achieving sustainable development purposes by considering materials from harvesting from natural resources step to removing step, it is tried in this article to explore various methods and technics and finally proper economics tools are identified and classified.

As economics investment is based on economics benefits, this research focuses on goods target price and provided services. The purpose is achieving to managerial policies and methods to consider environmental effects in target price of goods and services.

## 2. Method

In this research proper methods for all types of economics tools used in waste management are produced based on previous studies and similar experiences librarian. The methodology of this research is based on deduction of experiences in previous studies. A conceptual model and method about environmental economics, green accounting and sustainable development has been introduced using analytical and comparative processes of all green accounting methods and methodologies and obtained results in advanced countries experiences and sustainable development purposes. In addition, using analytical hierarchical process and paired comparison of various tools by experienced people and finally economics tools in waste management discussion and determining real target price of each good are classified and prioritized.

In this method, using various tools of gathering information including questionnaire and interview with experienced and skillful people we explore effective economics tools in determining real target value and green accounting in waste management. Then final pattern of methods classification and their relationships have been suggested using AHP method and Expert Choice software.

One of multi criteria decision making methods is analytical hierarchical process that is a decision making method that purpose is judgment among choices by having some of deciding factors about how to select choices in each factor.

Important steps of method are as following:

1. Hierarchical development
2. Finding relative numerical value
3. Paired comparison
4. Finding relative numerical value
5. Finding numerical implementation choice for each criterion and sub-criterion
6. Making implementation matrix of choices of previous steps
7. Multiple numerical implementations for relative numerical value
8. Adaptation

9. Process revising

Totally, calculation of achieving to implementation score (Pk) for each choice using AHP is shown in figure (1). Therefore, final decision making is returned to Pk. bigger score means better implementation of choice.

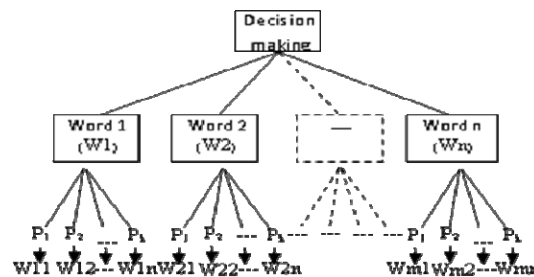


Figure 1. AHP structure

Matric  $n \times n$  is made by this method. Each cell in  $a_{ij}$  matrix is filled that shows factor  $i$  is prioritized on factor  $j$ . for intension of factor relative importance, it introduced 1 number in each hour between 1 to 9, when importance of criterion  $i$  equals or becomes more than criterion  $j$ ; on the other hand, it is varied between 1.1 and 1.9. Definition of importance degree of each criterion is shown in table 1.

Table 1. importance degree of AHP method

Relative prioritization	Description
1	When 2 words/ factors are equal according to decision maker point of view
3	Factor I is three times better than factor j
5	Importance of factor i is five times stronger than factor j
7	Importance of factor i is seven times stronger than factor j
9	Favorite judgment is biased more toward factor i
2, 4, 6, 8	The importance of factor i among numbers are more than the other mentioned ones

Resource: Ghodsipour, Seyyed Hassan, 2009.

Mentioned criterion in prioritizing economics tools are selected based on common characteristics in tools, operational and calculation disciplines of each method in determining real price and target price of good in waste management of other countries especially in waste market, green economics and accounting.

Therefore, desirable criteria are as following:

- 1-Being reasonable and practical
- 2-Easy access to method and needed software
- 3-Agreement of method with economics, social, and cultural conditions of countries
- 4-Obtained results from methods in related similar studies by determining target price of good, waste market and so on
- 5-Precise results
- 6-Flexibility of method in calculating value of all waste goods
- 7-Analysis with non-sophisticated and understandable methods.

3. Results

Common methods of environmental costs can be determined based on used definition in environmental costs and costs accounting suggested methods.

Implementation of economics tools makes high office demands and implementation of necessary conditions including good performance markets, enough organization capacity according to achieving related information

and supervision on illegal and favorite activities and their implementation, and finally political conditions especially it is probable many of economics tools (including taxes and payments that may have negative effect on competitiveness and faith) are not acceptable politically. There is weak probability it is implemented in developing countries, because Command and control instruments (CACs) mechanisms are dominant on environmental policies includes management of dry wastes in countries. Therefore, in developing countries evaluating conditions are important before implementation economics tools.

According to studies, total of economics tools are classified in 3 parts of income increasing economics tool, producing economics tool, and non-incoming economics tools. In addition, in valid scientific references including global bank, expertise team work of environmental economics of north Europe, environment of Canada, and United nations environment plan are also summarized that have common thing with the mentioned three classifications.

A) Income increasing (creator) tools: these tools include various allowances that intend more to direct bonus of favorite behaviors including reducing waste, improvement management with recycling. Allowances can be as direct expenses, reduction of taxes or other payments and access to credit. These tools tend more to accessible incomes of qualified subordinates.

Non-incoming tools: it includes trust-refund plans, paying incentives (while a good is purchased and refund is paid) and combine allowance (when a good is returned and) for dry waste management. Incentive-creating can include ownership right on information-oriented or low-oriented tool basis. Making or facilitating tools is a proper criterion for all part of producing or waste cycle. Policies of promoting competitive markets in waste management services instead of waste management office by public directly can change incentive in providing services. Experiences of related tenders are related to long-term contracts with service providers in private part is one of economics tools. In addition, Eco-labeling that considers goods with reproducible field and recognition of reproducibility of goods is another application of this method.

B) Income Increasing Tools: it includes various types of expenses and payments of users (tax or levies) for services of gathering, transferring, and final deposal services. This cases focus on "domesticating" outside action related to production, transfer, and deposal of wastes. Increased incomes from such payments may be attributed to solve a certain problem. There are many samples of such payments and taxes put under the title of income increasing economics tools such as related cases to pollutions based on amount of pollutants, wastes production works based on wastes amounts and their load harm degree and eco-taxes. In table 2 there are methods of triple classifications mentioned above.

Table 2. samples of economics tools based on triple classification

<b>Income maker</b>	<b>Non-income</b>	<b>Increasing income</b>
Pollution crimes	Product life cycle evaluation	Reducing crimes
Waste producing crimes	Trust-repayment	Taxes relief
Waste using crimes	Good return system	Credit taxes and tax relief
Waste equipping crimes	Transacting permissions	Research scholarships
Product crimes	Polluters black list	Investment in illegal stopping of carbon
Pollution taxes	Debt insurance	Development right for private companies for producing and disposing wastes
Eco-taxes	Guarantee and collateral	Investment cashes to improve environment
Potential taxes	Deprivations	
Taxes based on reproducible resources	Service providing priorities	
Reducing subsidies of using resources	Necessities related to recycling contents	
	Supervision on products	
	Divulge necessities	
	Detecting system of waste	
	Debt rule	
	Eco-label	
	Lien	
	Competitiveness and clarity in providing services	
	Managed competitiveness	
	Management contract based on performances	
	Competitiveness for clean city	

According to international classification and existed standards, it is classified in economics tools of global bank,

north Europe working team, Canada environment, and US environment plan.

Table 3. comparison of economic tools classification

US environment plan	Canadian environment	Northern Europe Working Group	World bank
Redefinition of ownership rights	Charges and penalties	Awards, charges and taxes	Fees, charges and taxes
Establishing markets (including negotiable permissions)	Negotiable permissions	negotiable permissions, bubbling, shares	Establishing markets (including ownership rights, trusting systems and negotiable trusts)
System of fees and charges	Trust – payback system	Supporting finances	Performance ranking
Financial tools (including taxes)	Trust – payback system	Trust – payback system	Debt laws (including performance guarantees)
Trust systems		Debt tables	Action for final applications (including environmental labels, educations, disclosure laws, blacklists, pollutants ranking)
Financial tool (including loans, limited advances, investments)			
Debts (including insurance)			

According to classification of World Bank, plan of UN, northern Europe and Canadian environment, economic tools and methods in accordance with the wastes management were evaluated and compared. For comparison of tools and their prioritization and finally, choosing the right tool, pairwise comparison in hierarchical analysis is used. In this regard, 5 main criteria of method flexibility, feasibility of execution in intended statistical population, level of proportion with goals of wastes management and integration were compared. To score these methods and their compatibility for prioritization, opinions of people who are completely familiar with the multi-criteria decision making and AHP, have sufficient skills and experience in wastes management, know statistical population and recognize the economic tools with respect to benefits, shortcomings and applications.

According to analyses, it was found out that among four classes of World Bank, US environmental plan, Canadian environment and northern Europe working group, World Bank methods have more integration with regard to covering all introduced tools and have more flexibility as a result of feasibility of execution in all parts of wastes management. All of the addressed economic tools in aforesaid classifications are in agreement with goals of wastes management. According to investigation of the history of application of these tools in other countries, such as northern Africa and India, these tools are effective in wastes management.

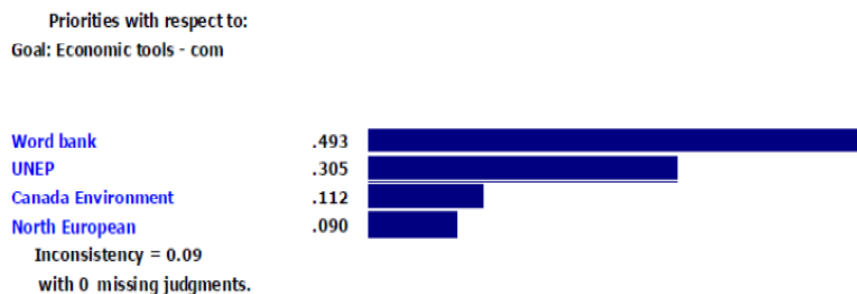


Figure 2. comparison of quadruple classes and their prioritization

Furthermore, according to introduced tools in each class, prioritization is performed for economic tools as well. Prioritization of economic tools by World Bank shows that market system and negotiable permissions are preferred over other tools. Moreover, often in comparison of methods, incentive tools and investment are preferred over penalty systems. In Figs. 3-6, prioritization of methods is illustrated.

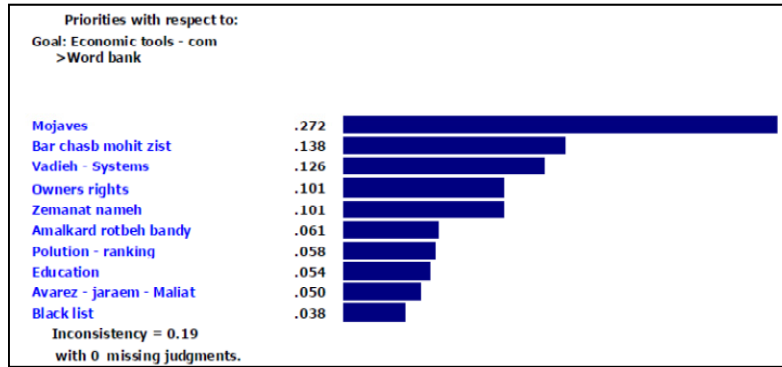


Figure 3. prioritization of economic tools by World Bank classification

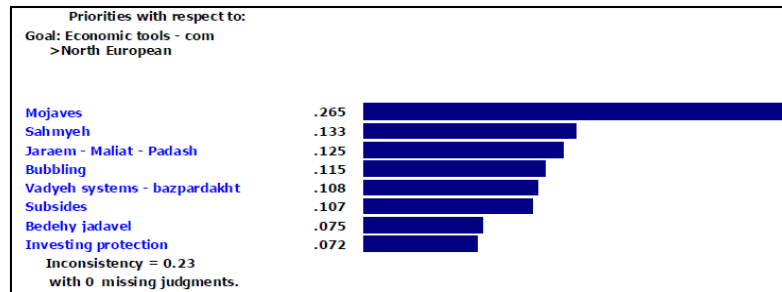


Figure 4. prioritization of economic tools by northern Europe classification

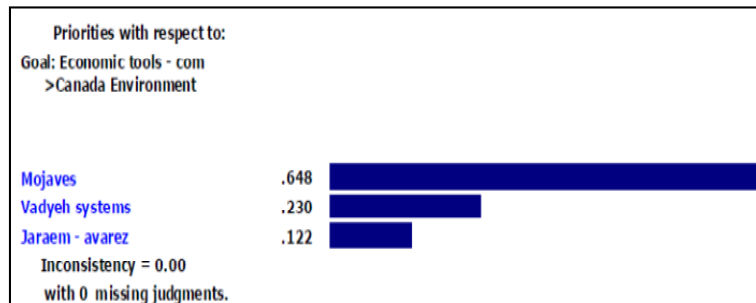


Figure 5. prioritization of economic tools by Canadian environment classification

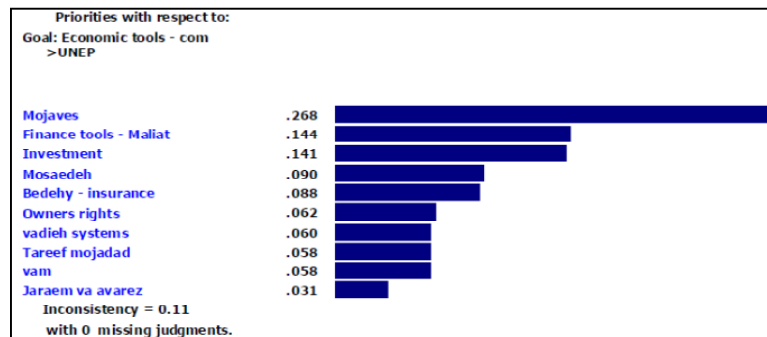


Figure 6. prioritization of economic tools by UNEP classification

#### 4. Conclusion

In general, economic tools are economic, flexible and effective in measurement, cost analysis and management of dry wastes. Moreover, they can lead to provide technologies of pollution control and making skills for private sectors. They can provide governments with income resources to support plans of wastes management and eliminate the government demand to more detailed information for determination of the appropriate level of

control for each of each part or product.

Specifically, in managing wastes, economic tools can be used as tools with the following purposes:

- Reduction of produced wastes
- Reduction of dangerous wastes portion in produced wastes
- Separation of dangerous wastes for shipment and repulsion
- Encouraging recycling, reuse and recovery of wastes
- Supporting justifiability of costs in collecting, transportation and repulsion of dry wastes
- Minimization of harmful effects of the system of collection, transportation and repulsion of dry wastes
- Making money for covering expenditures

Controlling strategies include direct laws regarding systems of evaluation and implementation systems. Such strategies require that local and regional governments prepare their waste standards and determine allocation of debts and charges corresponding to violation of regulations in order to meet standards, procedures and getting permissions for facilities.

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