Specifying balance in expense and time as a result of changing method of collecting and transporting rubbish at 22 districts of Tehran

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Abstract: The present research deals with specifying balance in expense and time as a result of changing method of collecting and transporting rubbish at 22 districts of Tehran. A research methodology is library &field if pacification of research is observed on goal, the present research is among applied research and based on infereneil-method it is descriptive research in wich with respect to design, the present research amonge post –event research . On this basis besides comprehensive study on related thematic literature and by using 8 aspects conceptual model and field studies at 22 districts of Tehran, have intended to collect data in 4 aspects related to time and 4 aspects related to cost. The collected data was analyzed by SPSS and Excel software. Results of this research indicate that upon changing traditional method to mechanized method, time of collecting rubbish, coming and going time, time of stop at place of discharging rubbish and time out of path(waste time) is decreased. Also within 4 aspects related to cost upon changing traditional method to mechanized method the cost of collecting and carrying rubbish, strategic cost and maintenance cost, cost of investment are increased and only cost of human work force is decreased. In general the results indicate that within aspect of time we are facing with decreasing time but in aspect of cost we are facing with increase. At the end of research, besides offering results and findings in detail the aforesaid issues are concluded, discussion and comparison, applied suggestions and suggestions related to continuation and following up similar researches are offered in future.

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Key Words: Time, Expense, Rubbish, Collection, Changing Method

Introduction:

Tehran by having area of 700km, population of 10 million people is regarded as the greatest, most populated, most traffic and most polluted cities of world by producing 7000ton rubbish. Until end of year 2005 citizens of Tehran produced pile of rubbish in front of their apartment and floor of street and by polluting environment and scenery of city, it is regarded as center for accumulating insects and harmful animals and each night many of these pollutions are transferred to different parts by step walking of people. On the other hand, upon population increase and permanent growth of cities, it is required for increasing level of consumed materials; consequently, increasing waste materials and entering it to the environment. Waste material is regarded as one of the most

important factors of pollution. If human intends to keep present growth and combat with such pollution, it is required to apply from technology management, engineering and economic principles for discharging waste materials. Within this unsuitable condition, rubbish is transferred, thrown and displaced by empty hand workers by remaining many sap and even increasing level of pollution. Excess transportation of low capacity rubbish machines is secondary factor of circulating pollution. Paying attention to environmental pollution through different environmental plans such as: management of solid waste materials is remarkably increased at global health and economy and the issue of rubbish recycle is created revolution at modern technology. Encouraging people to produce less rubbish and separating components of rubbish at production centers prepares suitable grounds for correct management of rubbish. It is to be noted that costs of collecting rubbish nearly covers 80% total annual budget of discharging waste materials which makes us to neglect traditional methods of engineering and public attitudes (Omrani 1995). Technological advancement has caused numerous changes at priorities. Meanwhile public health, economy and health have still specific importance, it is required for paying attention to environmental problems and relationship between discharging solid waste materials (Abdoli 2000). Failure in correct management of waste materials is regarded as environmental pollutants, so that in addition to ever growing pollution of soil, air, weather, environmental chain the human inhabitants is faced with serious problem. In addition to technologic achievements, ever growing rate of urban population, irregular development of urbanism, improving process of life, ever growing production of industrial and urban rubbish have caused many problems for collecting and discharging rubbish and sometimes pollution by rubbish and waste materials caused many abnormalities in society such as: endangering health of citizens (set of report 2007). Regarding all of the aforesaid factors simultaneously improves efficiency of mechanization plan and remarkable decrease at costs, pollution, transportation of vehicles, facilitation of operation, increasing safety, improving public health, citizenship culture, attracting public partnership and satisfaction of citizens.

Table 1: Research background

	Sequence	Researcher	Year	Results
Domestic Research	1	Naghavi	2005	Efficiency of mechanized method in neighborhood is higher since compression of population is very high, regions of collecting rubbish is high, distance of collecting rubbish, time of transportation is low and method of Neisan is appropriate for neighborhoods that compression of population is low and distance of collecting rubbish is very high
	2	Deputy of Urban Cities of Tehran Municipality	2000	Determining some technical indices for new stations according to the collected information
	3	Madani Shahroudi	1999	Offering model based on economic, social, technical, environmental considerations extending for designing and managing system of transferring waste materials at Tehran
	4	Sabzevari	2003	Not observing health and economic principles at provisional stations of collecting rubbish
Foreign Research	5	Koli Katra and et al	2009	Carrying out research at most sections of America on compost, legal nature, nature of waste materials, continuing attitude toward market for managing purification operation, liabilities and its consequences
	6	Gormad and et al	2009	Establishing effective models of management of solid waste materials at sample city
	7	Komara and et al	2009	Quantity and structure of waste material management from one place to the other is different and has fixed partial correlation with average life standard
	8	Hezare and et al	2009	Absence of having suitable facility (equipments and infrastructure) less estimation of production rate of waste materials, insufficient technical skill, unsuitable planning, non-competent person in charge of collecting rubbish, poor transfer of urban solid waste materials
	9	Shakdar	2006	Recommendation for obtaining to macro urban solid waste materials plan in relation to national policies, legal framework, technology management, operation management, financial management, awareness and public partnership

General Research Methodology:
Like other discussions of humanistic sciences, several different approaches are offered in relation to research methodology (Zohouri 1999). Generally all research methodologies are divided into 2 sections including: library and field; in which, this research benefited from both methods (Bazargan and et al 1998). If research is classified according to aim this research falls within applied research and in case of classification according to inferential method this research falls within descriptive-survey research and with respect to plan of research it is regarded as post-event.

Definition of Terms:
Time: It refers to transportation time, stop at discharge place and waste time for discharging rubbish
Cost: It refers to money paid for collecting rubbish until transferring it to station, investment costs for launching plan, keeping plan and personnel costs
Rubbish: It refers to all solid materials produced by human activities, different institutes and industries that are not applicable and from chemical point of view are classified as decomposition and non decomposition (Naghavi 2005)
Collection: It refers to operation of collecting solid waste materials and transferring them to specific place for discharging and keeping them (Madani 1999)
Change Method: Whereas method of collecting and transferring rubbish is changed from traditional method into mechanized method at Tehran municipality since year 2005; therefore, in order to compare aforesaid 2 methods the information of year 2003 until 2005 for traditional method and information of year 2006 until 2008 for mechanized method was compared.

Statistical Universe:
Statistical universe of this research is 22 districts of Tehran municipality

Sampling Method and Volume Sample:
By insisting on comparing traditional and mechanized method since year 2003 until 2008 the sampling was not performed and according to census method, all related statistics and information was studied

Meth of Collecting Data and Information:
Library and field method

Tools of Research:
Slip writing, table, form of benefiting references such as books, articles, journals, statistics for drawing up research literature, identifying effective variables and indices. Within descriptive research the descriptive information is collected through questionnaire, interview or observation and in this research the tools for collecting data are related to documents, interview and observation

Method of Analyzing Data and Information:

Statistical Method: This research benefit from descriptive statistics consisting of following items: mode, mean, average, range of changes, variance, standard deviation, dispersion, standard error, skewness coefficient and stretch coefficient

Research Model: Each conceptual model is regarded as basis for performing study and research, so that it determines desired variables and their relationship (Edward and et al 2000) i.e. conceptual model or MSM and analysis tool (Mirzaei 1998) is regarded as ideal strategy for beginning research, so that it is expected to study variables and their relationship and based on necessity to observe some amendments (to decrease or increase some factors) (Sater and Lizen 1999). This research applied from conceptual model (Naghavi 2005) (diagram 1)

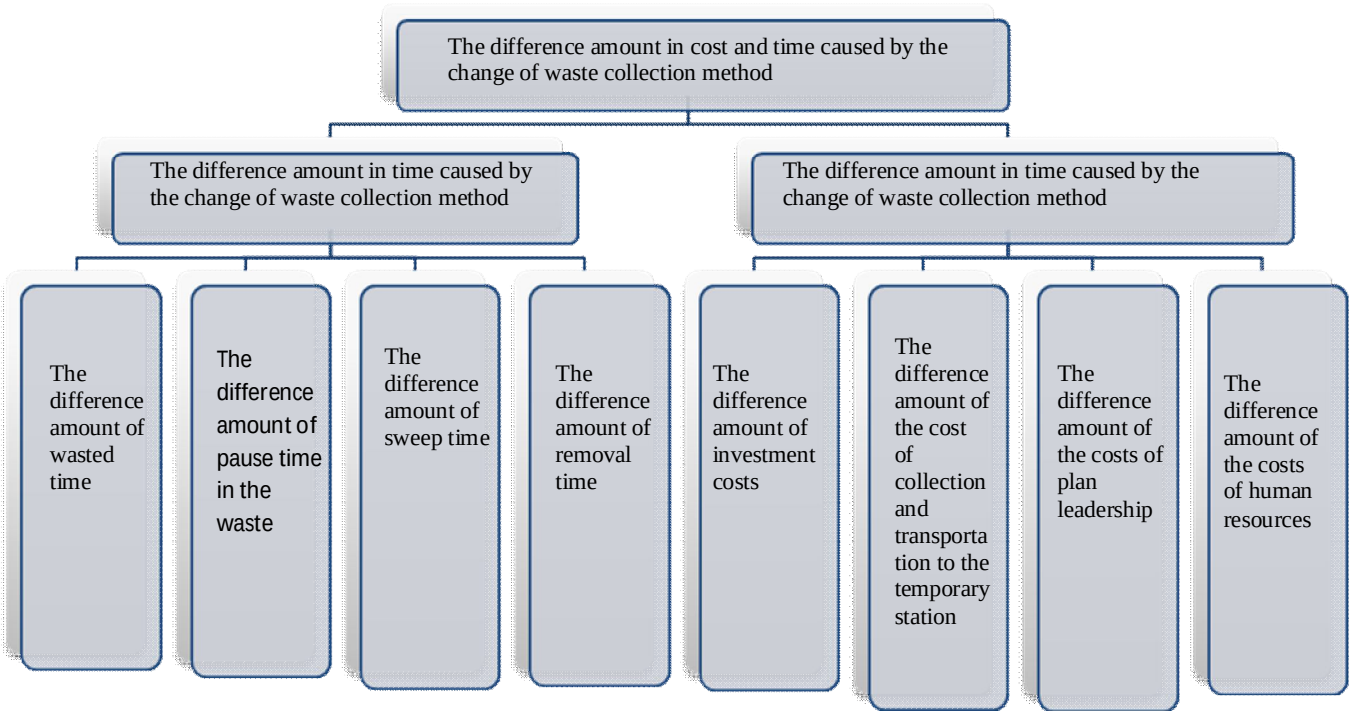


Chart 1

Research Variables & Defining Operation:

* Time of collecting rubbish based on type of collection system is divided into 2 groups including:

A) The time of collection within traditional collection method refers to required time for loading rubbish sacks or contents of rubbish container at Nissan Van; in which, this time is began with stop Nissan Van at the first rubbish sack to rubbish container until completing capacity of Nissan Van

B) Collecting rubbish with rubbish truck and container within mechanized method of collecting rubbish refers to time of reaching truck to the first rubbish container until completing capacity of truck

* **Transportation Time:** It refers to the required time for vehicle of collecting rubbish (Nissan Van or truck) from being filled until reaching to place of burying rubbish (discharge station), in addition it refers to required time that vehicle of collecting rubbish reaches to first sack or container of rubbish; in which, this time does not consists of stop by vehicle of collecting rubbish at discharge place (station)

* **Time of Stop at Burial Place (Discharge):** It refers to time between entrance and exit of vehicle for collecting rubbish to the station (place of discharging rubbish) and also expecting for discharging rubbish

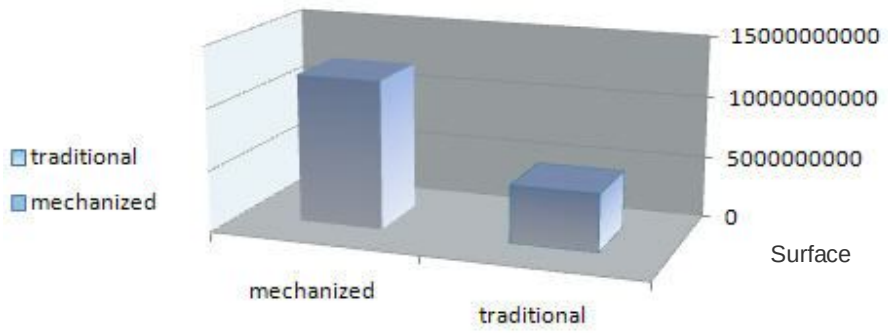
* **Wasted Time Out of Path:** It refers to time that no effective action is performed for collecting rubbish that is divided into 2 groups including:

A) **Required Useless Time:** It refers to time that collection and transportation system inevitably have to spend it, for example time spend at urban traffic, time that is spend for entering and exiting station, time that is spend for entering to the first station on night and returning to garage on morning, time that is spend at repair shop, changing flat tire and failure of machineries

B) **Non Required Useless Time:** Time that is spend for eating dinner, drinking tea and long time relax

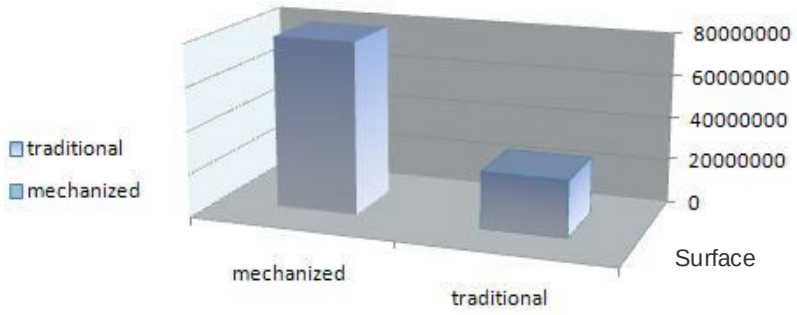
Analysis and findings of research:
At first, the tables of descriptive statistics are used to display data numerically and mode, median and mean as indices of central tendency, variation range, and standard deviation as indices of dispersion, and standard error, coefficient of deviation and coefficient of strain as indices of distribution are calculated. Also, columnar and polygonal charts are used in order to display data image to compare two methods of traditional and mechanized.

According to the Statistical indices related to the investigation of the cost of "transportation and collection of waste" and with emphasis on this point that there is a little difference between mode, median and mean and since the amount of coefficient of deviation and coefficient of strain is less than 1, it can be proposed that the above distribution has the assumption of normality. The mean cost of the transportation and collection of waste in traditional method and mechanized method is 4.669 Million Rials and 12.117 million Rials, respectively.



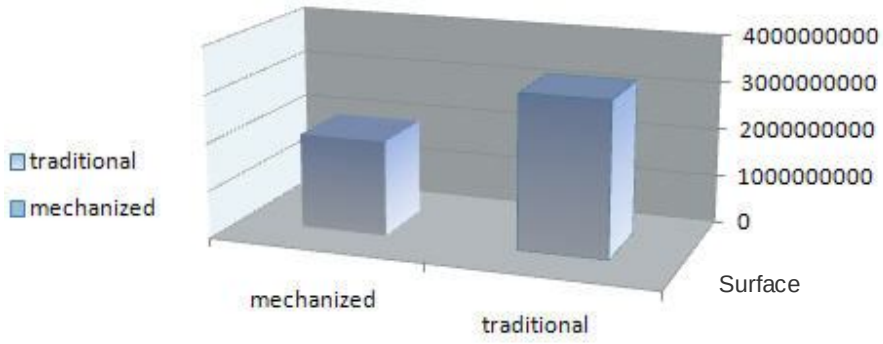
Charts related to Table 2.

According to the Statistical indices related to the investigation of the cost of "Leadership and Maintenance"and with emphasis on this point that there is a little difference between mode, median and mean and since the amount of coefficient of deviation and coefficient of strain is less than 1, it can be proposed that the above distribution has the assumption of normality. The mean cost of leadership and maintenance in traditional method and mechanized method is 262 Million Rials and 799 million Rials, respectively.



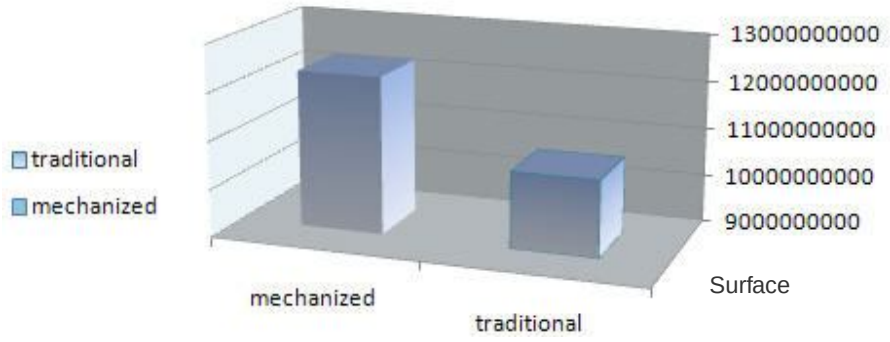
Charts related to table 3

According to the Statistical indices related to the investigation of the cost of "human resources" and with emphasis on this point that there is a little difference between mode, median and mean and since the amount of coefficient of deviation and coefficient of strain is less than 1, it can be proposed that the above distribution has the assumption of normality. The mean cost of human resources in traditional method and mechanized method is 3.233 Million Rials and 198 million Rials, respectively.



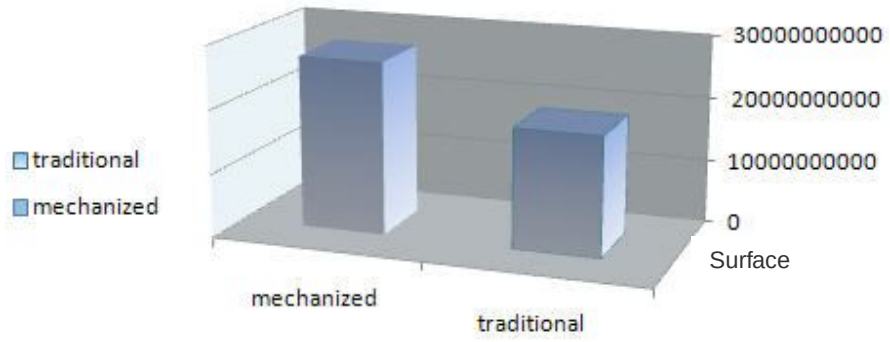
Charts related to table 4.

According to the Statistical indices related to the investigation of the cost of "investment" and with emphasis on this point that there is a little difference between mode, median and mean and since the amount of coefficient of deviation and coefficient of strain is less than 1, it can be proposed that the above distribution has the assumption of normality. The mean cost of investment in traditional method and mechanized method is 10.598 Million Rials and 12.298 million Rials, respectively.



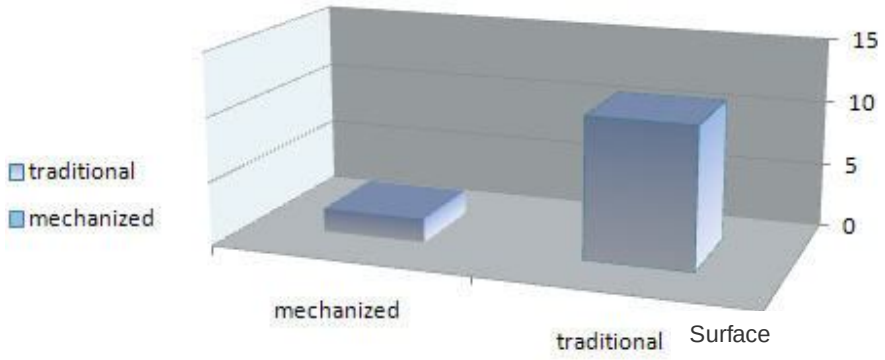
Charts related to table 5

According to the Statistical indices related to the investigation of "total" cost and with emphasis on this point that there is a little difference between mode, median and mean and since the amount of coefficient of deviation and coefficient of strain is less than 1, it can be proposed that the above distribution has the assumption of normality. It should be mentioned that the total mean of the cost of the transportation and collection of waste in traditional method and mechanized method is 18.763 Million Rials and 27.203 million Rials, respectively.



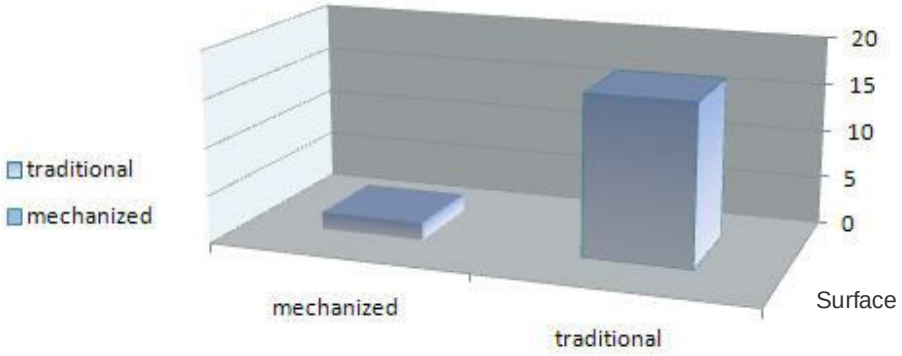
Charts related to table 6

According to the Statistical indices related to the investigation of the time of “pause in the waste dumping site»and with emphasis on this point that there is a little difference between mode, median and mean and since the amount of coefficient of deviation and coefficient of strain is less than 1, it can be proposed that the above distribution has the assumption of normality. It should be mentioned that the mean time of “pause in the waste dumping site»” in traditional method and mechanized method is 11 minutes and 1/86 minutes, respectively.



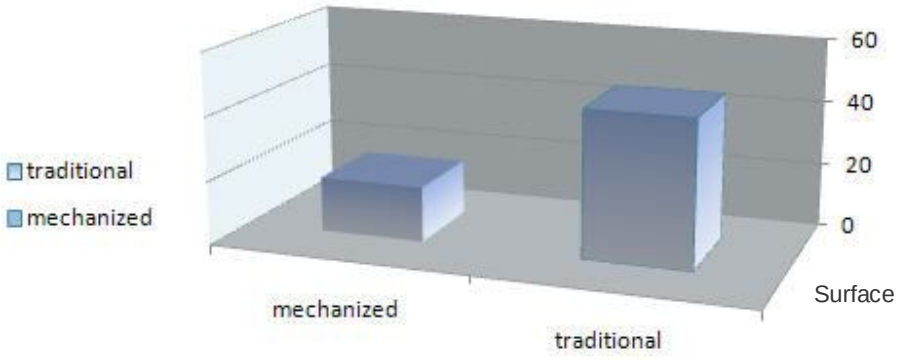
Charts related to the table 7

According to the Statistical indices related to the investigation of the time of "sweep"
and with emphasis on this point that there is a little difference between mode, median and mean and since the amount of coefficient of deviation and coefficient of strain is less than 1, it can be proposed that the above distribution has the assumption of normality. It should be mentioned that the mean time of "sweep" in traditional method and mechanized method is 16/75 minutes and 1/80 minutes, respectively.



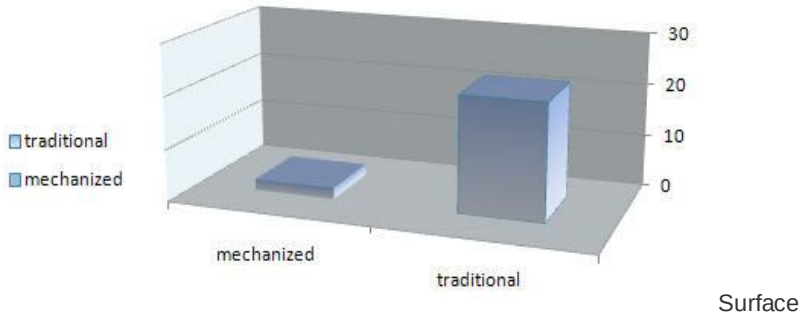
Charts related to the table 8

According to the Statistical indices related to the investigation of the time of "waste removal"and with emphasis on this point that there is a little difference between mode, median and mean and since the amount of coefficient of deviation and coefficient of strain is less than 1, it can be proposed that the above distribution has the assumption of normality. It should be mentioned that the mean time of waste removal in traditional method and mechanized method is 44/61 minutes and 17/22 minutes, respectively.



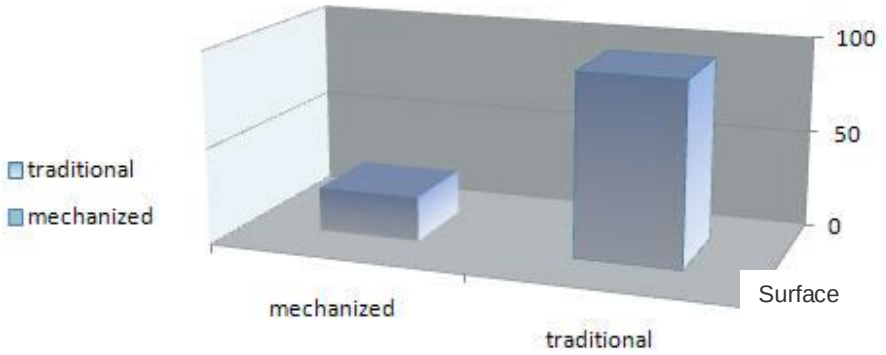
Charts related to the table 9

According to the Statistical indices related to the investigation of time "out of the path (lost)"and with emphasis on this point that there is a little difference between mode, median and mean and since the amount of coefficient of deviation and coefficient of strain is less than 1, it can be proposed that the above distribution has the assumption of normality. It should be mentioned that the mean of time out of the path (lost) in mechanized method and traditional method is 2/11minutes and 22/19 minutes, respectively.



Charts related to the table 10

According to the Statistical indices related to the investigation of "total" time and with emphasis on this point that there is a little difference between mode, median and mean and since the amount of coefficient of deviation and coefficient of strain is less than 1, it can be proposed that the above distribution has the assumption of normality. It should be mentioned that the mean of total times in mechanized method and traditional method is 23 minutes and 94/55 minutes, respectively.



Charts related to the table 11

Conclusion:

Subsidiary Questions:

* What is time of collecting rubbish from changing traditional method into mechanized method? Average time of collecting rubbish in total districts of Tehran by traditional method from year 2003 until 2005 is 44.61min and by mechanized method from year 2006 until 2008 is 17.22 min; consequently, average monthly time of collecting rubbish at mechanized method is 27.39min less than traditional method

* What is transportation time of rubbish from changing traditional method into mechanized method? Average time of transportation in total districts of Tehran by traditional method from year 2003 until 2005 is 16.75min and by mechanized method from year 2006 until 2008 is 1.8 min; consequently, average monthly time of transportation at mechanized method is 14.95min less than traditional method

* What is time of stop at rubbish discharge station from changing traditional method into mechanized method? Average time of stop at rubbish discharge station in total districts of Tehran by traditional method from year 2003 until 2005 is 11min and by mechanized method from year 2006 until 2008 is 1.8 min; consequently, average monthly time of stop at rubbish discharge station by mechanized method is 9.20min less than traditional method

* What is wasted time from changing traditional method into mechanized method? Average wasted time in total districts of Tehran by traditional method from year 2003 until 2005 is 22.19min and by mechanized method from year 2006 until 2008 is 2.11 min; consequently, average monthly wasted time by mechanized method is 20.08 less than traditional method

* What is cost to be paid for collecting and carrying rubbish to provisional station from changing traditional method into mechanized method? Average cost to be paid for collecting and carrying rubbish to provisional station in total districts of Tehran by traditional method from year 2003 until 2005 is Rls 4,669,145,750 and by mechanized method from year 2006 until 2008 is Rls 12,117,151,201; consequently, average monthly cost to be paid for collecting and carrying rubbish to provisional station by mechanized method is Rls 7,448,005,451 higher than traditional method

* What is investment cost for launching plan from changing traditional method into mechanized method? Average investment cost for launching plan in total districts of Tehran by traditional method from year 2003 until 2005 is Rls 10,598,181,818 and by mechanized method from year 2006 until 2008 is Rls 12,298,363,636; consequently, average monthly investment cost for launching plan by mechanized method is Rls 1,700,181,818 higher than traditional method

* What is strategic and keeping cost of plan from changing traditional method into mechanized method? Average strategic and

keeping cost of plan in total districts of Tehran by traditional method from year 2003 until 2005 is Rls 262,061,056 and by mechanized method from year 2006 until 2008 is Rls 799,506,397; consequently, average monthly strategic and keeping cost of plan by mechanized method is Rls 537,445,341 higher than traditional method

* What is cost of human workforce from changing traditional method into mechanized method? Average cost of human workforce in total districts of Tehran by traditional method from year 2003 until 2005 is Rls 3,233,960,836 and by mechanized method from year 2006 until 2008 is Rls 1,988,355,272; consequently, average monthly cost of human workforce by mechanized method is Rls 1,245,605,564 less than traditional method

With respect to average costs of both methods, the cost of human workforce in traditional method is higher; meanwhile, cost of keeping and carrying rubbish until provisional station, strategic and keeping cost of plan and investment cost in mechanized method is higher than traditional method. Average time of both methods reveal that within traditional method the time of stop at place of discharging rubbish, transportation time, time of collecting rubbish and waste time is higher than mechanized method

Principal Research Questions:

* What is difference between cost and time in case of changing method of collecting and carrying rubbish at 22 districts of Tehran? Total monthly average spent costs from time of collecting rubbish until its discharge at station in total districts of Tehran by traditional method from year 2003 until 2005 is Rls 18,763,349,460 and by mechanized method from year 2006 until 2008 is Rls 27,203,376,508; consequently, total monthly average cost by mechanized method is Rls 8,440,027,048

* Total monthly average time from collecting rubbish until its discharge at station in total districts of Tehran by traditional method from year 2003 until 2005 is 94.55min and by mechanized method from year 2006 until 2008 is 23min; consequently, total monthly average time by mechanized method is 71,55min less than traditional method

Applied Recommendation in the way of Domain of Research:

Changing method of collecting rubbish and stabilizing items of urban service from traditional method into mechanized method has satisfactory achievements with respect to environmental, social and cultural aspects; therefore, according to the results of this research, following recommendations are offered for decreasing related time and costs:

1) Optimum localization of transfer stations in Tehran

2) Correct localization and topology of regions for collecting rubbish by minimizing transportation path

3) Applying containers with higher capacity for minimizing number of required times for discharging; consequently, decreasing waste time, decreasing cost of carrying and collecting rubbish

4) Establishing suitable culture through media for citizens to put their rubbish exactly at 9 p.m. (hour of beginning urban service) in front of their homes due to not repeating this service during day

5) Whereas contractor of green space began his work at 6 a.m. which is simultaneous with termination work of urban service contractor, it is recommended to make arrangement between 2 contractors or minimizing merging their affairs in order to decrease wasted time and not intervention of their affairs

6) In order to facilitate time of discharging rubbish from container it is recommended to make arrangement with Traffic Department to prevent from park vehicles in front of rubbish container through applying fine, installing No Stop sign and prevent from park vehicles

7) Designing path of collecting rubbish should be so that the final collection station is preferably be very close to discharging station

8) At the present time many persons under title of inspector, supervisor, fourth factor… supervise and control over performance of vehicles and contractors that due to having different attitudes, many contractor and employers are dissatisfied and increases costs. Therefore, through installing Online G.P.S by showing path on map and movement information such as report of stop, transportation in the defined area or unauthorized area, report of infringement from authorized speed and level of consumed fuel it is possible to optimally manage all stages such as supervision over performance of human and vehicle in order to minimize costs and time

9) Through installing scale system (weight measurement system) on arms of vehicles for carrying rubbish it is possible to measure weight of each container while discharge and by using GPS system installed on vehicle, to register information related to weight of rubbish and register it in system and to analyze rubbish according to alley and neighborhood separately, which assists for correct cost and time management for collecting and carrying rubbish

10) Through benefiting from GIS (Global Positioning System) system it is possible to determine the shortest possible path for collecting and carrying rubbish according to impediments such as: traffic, blocked roads… which increases speed and decreases wasted time and decreases costs of carrying and collecting rubbish

11) In order to minimize mechanization plan we evaluated aforesaid plan and by using SWOT (Strength, Weakness, Opportunities, Threats) model we investigated strong points, weak points, threats and opportunities for having maximum efficiency

Recommendations for Further Research:

1) Recognizing effective environmental, mental, social, cultural and political factors on economizing at cost and time of mechanization method in Tehran

2) Studying potentials of applying new technology in the field of management of solid waste materials in Tehran

Limitations of Research:

1) Delegating power of cleaning roads affairs from Tehran municipality to motorized service organization (waste material management organization) in fiscal year 2006 and change at management and method registering information: whereas costs of collecting the produce waste materials of Tehran from year 2003 until 2008 is studied many of information was related to period before mechanization (years before 2005) and information should be collected from 123 districts; nevertheless, due to this fact that this information was not related to a concentrated unit of a department, there were some problems for collecting such information. In addition the criterions of registering information during recent 2 periods (period before year 2006 and after year 2006) were based on traditional method; nevertheless, at mechanization method the statement is based on number of personnel and hour; consequently, there is no compatibility between comparisons and integrating this information was very complicated

2) Merging motorized service organization (waste material management organization) and recycle organization (waste material management organization): whereas merging both organizations and not establishing organizational structure and a new detailed organization, the waste material management organization due to enforce elimination was not able to meet the requirements of departments and collecting related information.

references list:

1. .Abdoli, Mohammad Ali, (2000), Recycling and disposal of urban solid waste, publication of organization of municipalities of Country.
2. Bazargan, Abbas et al. (1998), investigation methods in the behavioral sciences, Tehran: Agah publications.
3. Deputy of research and education, (2000) , optimizing the existing stations and locating the new stations of Tehran city, Tehran: Deputy of urban services of Tehran Municipality, organization of material recycling and conversion , report number 2,

determining the number of loading sideways in platforms and the toxic number of needed semitrailers in stations.

4. Edwards, M. et al., (2000), NGOs in a global future: Marrying local delivery to world wide leverage, NGOs Conference.

5. Guermoud, N., Ouadjnia, F., Abdelmalek, F., Taleb, F. & Addou, A., (2009), Municipal solid waste in Mostaganem city(Western Algeria), Waste Management 29, pp. 896-902.

6. Hazra, Tumpa. & Goel, Sudha., (2009), Solid waste management in Kolkata, India, practices and challenges, Waste Management 29, pp. 470-478.

7. Kollikkathara, Naushad., Feng, Huan. & Stern, Eric., (2009), A purview of waste management evolution: special emphasis on USA, Waste Management 29, pp. 974-985.

8. Kumar, Sunil., Bhattacharyya, J.K., Vaidya, A.N., Chakrabarti, Tapan., Devotta, Sukumar. & Akolkar, A.B., (2009), Assessment of the status of municipal solid waste management in metro cities, state capitals, class I cities, and class II towns in India: An insight, Waste Management 29, pp. 883-895.

9. Maastricht School of Management, Preliminary research proposal outline form, MSM, 2001.

10. .Madani Shahroodi, Homayun Reza, (2000), optimizing the existing stations and locating new stations of solid waste transfer of Tehran city, Tehran: Deputy of urban services of Tehran Municipality, organization of material recycling and conversion, Deputy of research and development.
11. .Mirzaee Ahranjani, Hassan, (1998), design a model to determine the effective factors on work conscience and social discipline, articles of the seminar of work conscience and social discipline, Qazvin: publication of Islamic Azad University, Qazvin unit.

12. Naghavi, Reza, (2005), analysis, comparison and optimization of the techniques of transportation and collection of waste in region 1, zone 8, Tehran Municipality and providing an appropriate mathematical model, Tehran: Islamic Azad University, science and research unit, the thesis of the master of environmental engineering.
13. .Omrani, Qasem Ali, (1995), solid waste materials, publication of Islamic Azad University.
14. Sabzevari, Shadan, (2003), environmental investigation of waste transfer stations with emphasis on Tehran city, Tehran: Islamic Azad university, Tehran north branch, engineering and technical faculty, environmental engineering group, the thesis of master.
15. Set of reports, (2007), mechanization of urban services, publication of department of Public and International Relations of Tehran Municipality

16. Shedkar, Ashok. V., (2006), Sustianable solid waste management: an integrated approach for Asian countries, Waste Management 29.

17. . Zohuri, Ghasem, (1999), application of the research methods of social sciences in management, Tehran: Mir publications

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