



Performance Assessment of Municipal Solid Waste Management Model of Lahore: A Case Study of Two Turkish Contractors

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Abstract: The solid waste management (SWM) trends are changing rapidly in big urban centers. For improving efficiency of service delivery, invariably the collection and transportation services are outsourced to private contractors. The Lahore Waste Management Company (LWMC) also outsourced their services to two Turkish contractors: Contractor-A and Contractor-B. The objective of this study was to evaluate the performance of these contractors. For this purpose two (02) performance assessment models were developed; one for service recipients and second for SWM contractor's staff. Key performance indicators (KPIs), as developed by the LWMC, were evaluated and the relevant indicators concerning techno-social aspects were selected corresponding to each model, to assess the service delivery level by the contractors. A questionnaire was developed for each model. Data was collected from 40 Union Councils (UCs) of Lahore. 384 service beneficiaries and 68 concerned officials were interviewed from all the selected UCs. The Statistical Package for Social Sciences (SPSS) was used for data analysis. The analysis revealed that from the service beneficiary point of view, the service delivery is satisfactory, however requires certain improvements. It is also deduced that overall performance of both the SWM contractors is encouraging; however, they need improvements primarily in some sectors, like public awareness plans, staff trainings and availability of vehicles and equipment. Overall, performance of Contractor-B is better in all KPIs as compared to the Contractor-A.

Keywords: solid waste management (SWM), Turkish SWM contractors, performance assessment, consumer satisfaction, LWMC, service delivery in SWM

1. INTRODUCTION

More than half of the world's population lives in urban areas. Urban population growth rate varies among countries and regions. In south Asian countries, over the past 50 years, urban population has grown by about 300 million people. As the region's population has become more urbanized, the number and size of the cities has increased as well as generation rate of municipal solid waste (MSW) [1]. Management of solid waste has emerged as a major environmental issue in big urban settings.

Lahore is the second largest city of Pakistan. Its population is around 9 million [2]. The daily municipal solid waste generation in Lahore city is about 5500 tons [3]. The responsibility of solid waste management in Lahore remained with the City District Government till 2010. A study in year 2007 revealed that only 70% of the waste, generated in Lahore, was collected and sent to

open dumping sites (Mehmood Booti Dumpsite, Baggrian Dumpsite, Saggian Dumpsite and Tibba Dumpsite); the rest remained on streets, roads or open spaces. The open dumping sites turned into breeding grounds for disease vectors, communication of different diseases and produced objectionable odours. Furthermore, household waste was mostly collected through hand carts or donkey carts and municipality did not have modern and sufficient waste collection equipment [4].

Main reasons of poor MSW management in Lahore includes: (1) lack of strong commitment on the part of government to introduce institutional and management reforms for managing urban waste; and (2) lack of modern storage, collection and transportation equipment.

Realizing the aforementioned situation, City District Government Lahore (CDGL) established a corporate body 'Lahore Waste Management

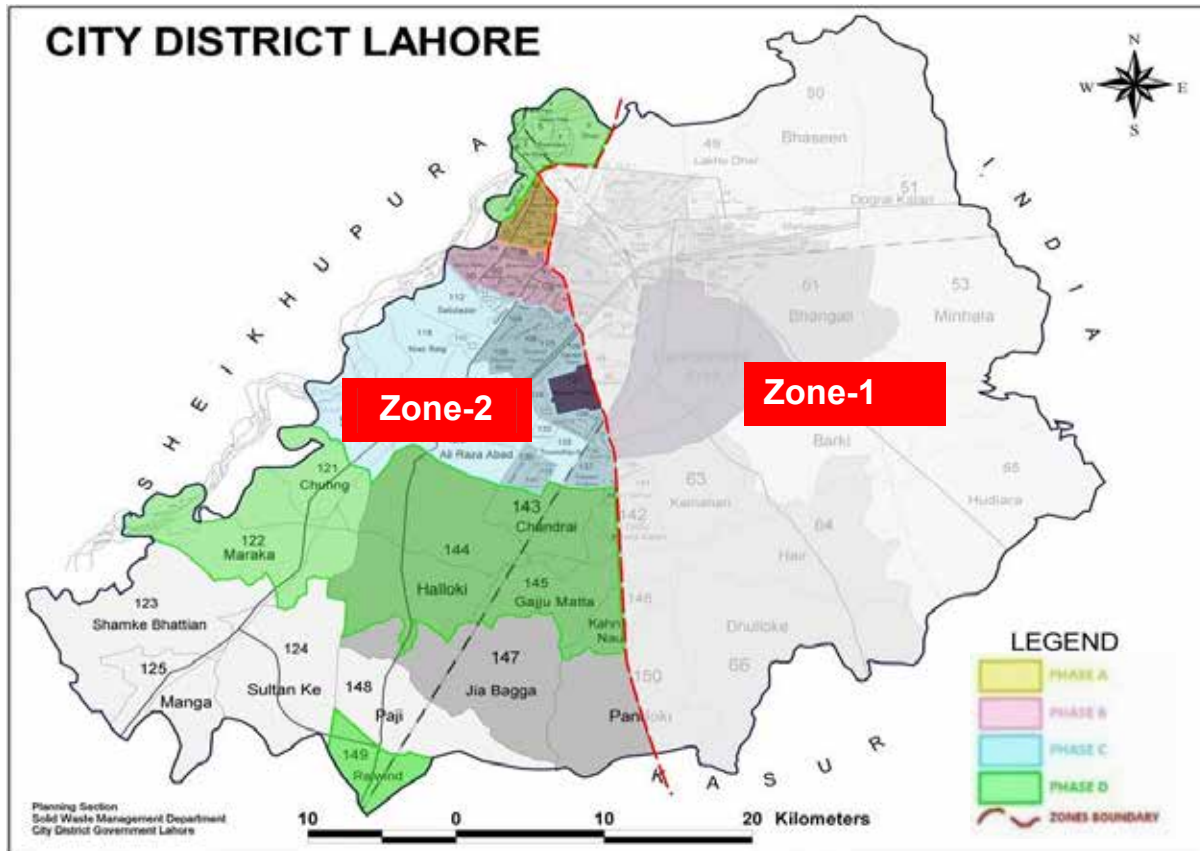


Fig. 1. Zoning of Lahore for SWM. (Source: Planning Section, SWM Department, CDGL)

Company (LWMC)' on 19th March 2010 for waste management service delivery in Lahore. It was a new institutional set up with professionals hired on market based remunerations. Modern management tools like vehicle tracking & management system, android phones, complaint registration and redress systems were employed. For the purpose of operations, the entire Lahore was divided into two zones (Fig. 1). Ferozpur Road is the dividing line for the two (02) zones. Two (02) Turkish companies Contractor-A and Contractor-B, were hired and were entrusted with zone-1 and 2, respectively.

These contractors appear to play an efficient role to improve the SWM in the city, however there are still some concerns regarding reforms brought about by these contractors at various levels [5]. They are paid USD 25 per ton of the waste collected. This cost is often criticized to be on higher side. The cost figure reported from within Pakistan lies in a range of USD 10 to 15 per ton. However, the service delivery standards for lower cost is also inferior. From the neighboring country India, the cost in Mumbai is USD 44 per ton by Municipal Corporation Greater Mumbai [6]; in Chennai it

is USD 33 per ton by Corporation of Chennai[7] and another figure reported from India is USD 16 per ton[8]. It is also noted that inclusion of private sector and community may reduce the cost per ton by about 30% [6-8].

After the establishment of LWMC and outsourcing of collection and transportation to the Turkish contractors, there was no systematic study conducted to evaluate the performance of the new arrangement for solid waste management in Lahore. Thus, the present study aimed at evaluating the performance and identifying areas for further improvement.

2. MATERIALS AND METHODS

To achieve the objectives of study two (02) performance assessment models were developed i.e. service recipients assessment model; and service contractor's competence assessment model [9]. These models consider both social and technical inputs. The first model addresses expectations and judgment of the service beneficiary. Second model is devoted to attributes and performance of the

contractors. Both of these models rely on the views of service beneficiaries and concerned officials and do not rely on self-observation.

2.1 Service Beneficiary Assessment Model (SBAM)

This model considers views and degree of satisfaction with the SWM service as expressed by the service beneficiaries and builds upon the key performance indicators (KPIs) pointed out in Table 1. On the basis of KPIs stated in Table 1, a questionnaire was developed for SBAM. This questionnaire was designed on three (03) point Likert Scale [13-16]. Each question contained different expected answers based on the degree of satisfaction of service beneficiaries.

After the development of questionnaire, the study area was selected for survey and to fill the questionnaires. It was selected on the basis of Purposive Sampling. Purposive sampling is a sampling method in which elements are chosen from among the whole population based on purpose of the study. The main objective of purposive sampling is that the researcher, with his good decision and appropriate policy, chooses those elements which are meant for fulfilling the research objective [17]. Lahore has nine (09) towns containing 146 Union Councils (UCs) [18]. Total forty (40) UCs were selected from all the nine (09) towns. Twenty (20) UCs were selected for each contractor i.e. 20 for Contractor-A and 20 for Contractor-B. The selected UCs for both contractors are listed in Table 2.

After selection of the study area, the sample size (i.e., number of people to be interviewed) was calculated. The present population of the selected UCs was calculated by using the population data of 1998 Census Report [19]. The Sample Size of 384 people was computed, using 95% confidence level [20].

2.2 Service Contractor's Competence Assessment Model (SCCAM)

This Model assesses the contractor's ability based on six (06) KPIs, considered to be the main factors that influence the contractor's performance. These KPIs are enlisted in Table 3. On the basis of aforementioned KPIs, a sample questionnaire for Service Contractor's Competence Assessment Model (SCCAM) was developed using three (03) point Likert Scale. The sample

size for 90% confidence level came out to be 68. A lower confidence level (90%) for SCCAM, when compared with SBAM (95%), was used. The reason was availability of backup data for all answers obtained from concerned officials of both SWM contractors, hence justified. These questionnaires were filled for concerned officials of selected UCs, i.e., by officials from the offices of Contractor-A, Contractor-B and LWMC.

2.3 Data Entry and Analysis

After the questionnaire surveys and interviews, all the data were entered in the Statistical Package for the Social Sciences (SPSS) software for analysis [21].

3. RESULTS AND DISCUSSION

3.1 Service Beneficiary Assessment Model (SBAM)

The results, based on SPSS analysis, are presented in this section. As stated already, 384 service beneficiaries were interviewed from forty (40) UCs. Out of these, 345 were males and 39 females; out of these 384 total beneficiaries, 317 were literate and 67 illiterate. The details of the findings based on SPSS analysis are discussed in the following sections:

3.1.1 Public Awareness on SWM Operations

- i. Details of public awareness are presented in Fig. 2. It can be seen that about 49% respondents from the Contractor-A and 53% from the Contractor-B service area, were aware about the working of private contractors. No response was received from some segment of the respondents. Thus the performance can be ranked as "average" on this KPI (Table 4). It warrants greater efforts on the part of LWMC and the contractors on awareness issue.
- ii. In the Contractor-B service area, the public of Garden Town UC was found most aware and Shahdara UC least aware. Whereas community of Race Course UC was found most aware and Al-Faisal Town UC least aware in the Contractor-A service area. Public awareness campaigns were not launched in the area; it was reported by many respondents.
- iii. Fig. 3 shows the state of general cleanliness

Table 1. KPIs for SBAM.

Sr. No.	KPI	Description
1	Public awareness on SWM operations	% of the people aware of the Contractor's operation
2	General cleanliness of the service area	% of people satisfied with the level of cleanliness in the area
3	Acceptability of the quality of the service	% of people satisfied with the quality of service of the contractors in their area
4	Quality of customer service	% of people satisfied with the customer service

Table 2. Union councils selected for the study.

Sr. No.	Zone-1 (Contractor-A)		Zone-2 (Contractor-B)	
	Town	Union council	Town	Union council
1	Data Ganj Baksh	Race Course	Data Gunj Baksh	Riwaz Garden
2		Mozang		Bilal Gunj
3		Gulberg		Sanda Khurd
4	Gulberg	Naseer Abad	Gulberg	Faisal Town
5		Crown Park		Pindi Rajputan
6		Mujahidabad		Garden Town
7		Begum Pura		Gulshan-e-Iqbal
8	Shalimar	Baghbanpura	Samanabad	Muslim Town
9		Taj Bagh		Nawan Kot
10		Al-Faisal Town		New Samanabad
11	Aziz Bhatti	Harbanspura	Allama Iqbal	Township
12		Mughalpur		Johar Town
13		Siddique Pura		Niaz Beg
14	Ravi	Rang Mahal	Ravi	Sabzazar
15		Muslim Abad		Aziz Colony
16	Wagah	Darogha Wala	Ravi	Shahdara
17		Salamat Pura		Kot Begum
18		Lakho Dhair		Green Town
19	Nishtar	Sittara Colony	Nishtar	Chandrai
20		Dulu Kalan Khurd		Farid Colony

Table 3. KPIs for SCCAM.

Sr. No.	KPI	Description
1	Public awareness plans	Formulation of public awareness plans on regular basis
2	Work operation strategies and practices	Quality of work operations and practices; operations monitoring, optimized operational plans and continuous evaluation.
3	Training of employees	Existence of training programs for capacity development of the employees
4	Protection of public health and the environment	Ensuring use of personal protective equipment in operation by the concerned officials.
5	Equipment and facilities owned by the contractor	Quality of equipment and facilities % of the actual machinery deployed in comparison with the machinery to be deployed as per contract
6	Solid waste collected and disposed	% of waste collected and disposed.

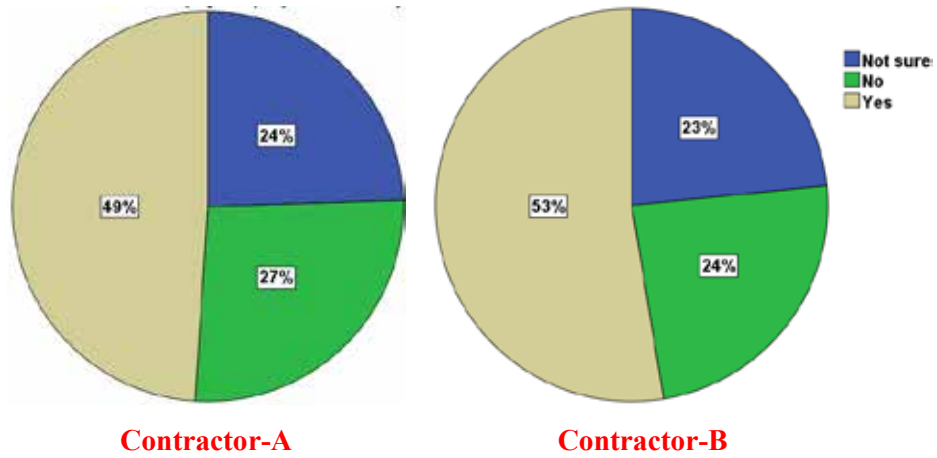


Fig. 2. Public awareness on SWM operations.

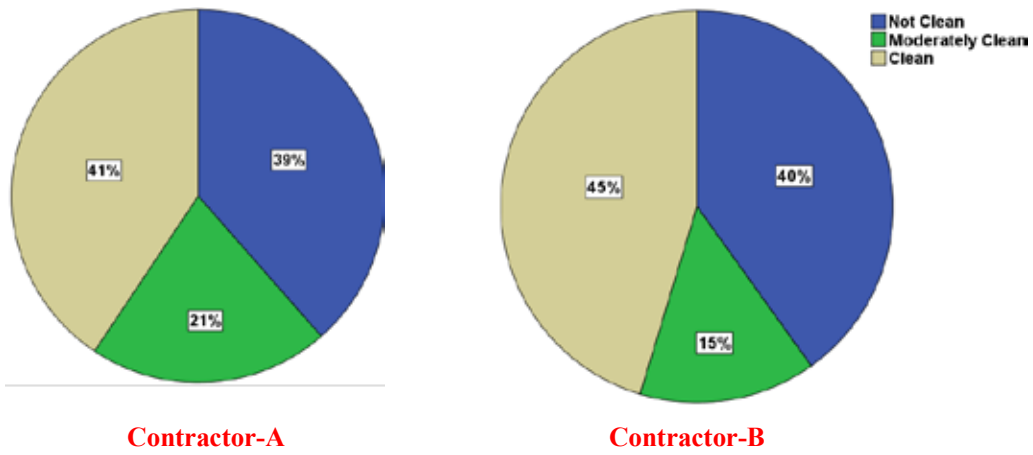


Fig. 3. Respondent's views regarding the extent of cleanliness.

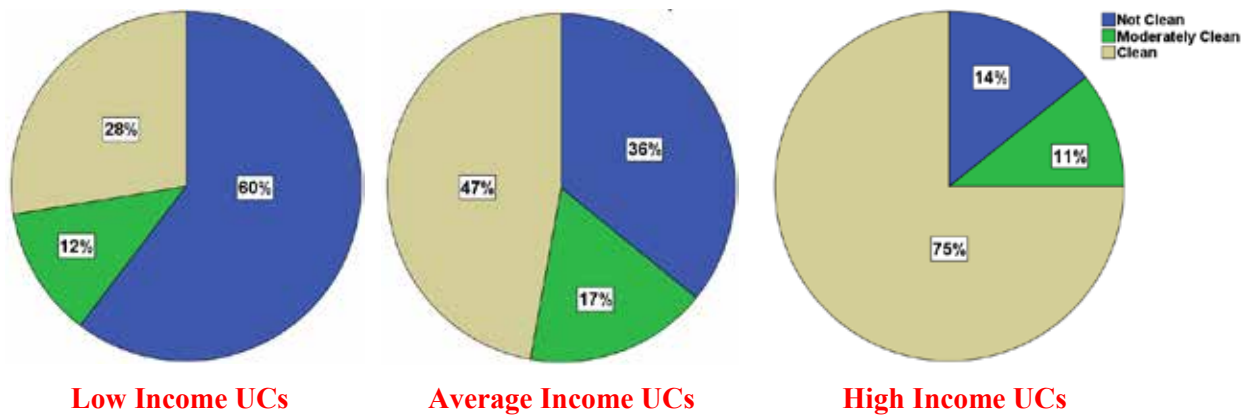


Fig. 4. Public satisfaction on income level basis in OZAPK service area.

Table 4. Likert scale used for evaluation.

Sr. No.	Likert scale	Percentage (%) of people satisfied with the service
1.	Poor performance	0-35
2.	Average performance	35-70
3.	Good performance	70-100

in the service areas of each contractor. It is clear that respondents from the area where Contractor-B is operating were found more satisfied regarding the cleanliness of their area as compared to Contractor-A; since 45% respondents from Contractor-B and 41% from Contractor-A service area said that their areas remain clean. The performance for this KPI, for both the contractors, fall in the “average” category. It shows more efforts are required on the part of both contractors. The answer, moderately clean, was not included in performance evaluation.

- iv. Public satisfaction with the extent of cleanliness was higher in affluent neighborhoods as compared with low and average income areas. In the Contractor-B service area, about 28% respondents from low income UCs, 47% from average income UCs and 75% from high income UCs said that their areas remain clean. Whereas in the Contractor-A service area, about 24% respondents from low income UCs, 42% from average income UCs and 77% from high income UCs said that their areas remain clean. Fig. 3 and Fig. 4 show the respondents’ satisfaction on the basis of income level in the service areas of both SWM contractors.
- v. Another underlying reason of the good and poor performance of the same contractor in different income group areas was the state of infrastructure facilities (roads, streets, etc.). The extent of cleanliness was found better in the areas with better and wider roads (i.e., Gulberg, Race Course, Garden Town, etc.) as compared to the areas with poor and narrow roads (i.e., Lakho Dhair, Thokar Niaz Beig, etc.). Perhaps, use of small size collection vehicles in low or middle income group could improve the public satisfaction levels in these areas.
- vi. However, most of the respondent from the service area of both SWM contractors said that situation of cleanliness improved in their area

after introducing the private SWM contractors. In addition, current SWM system is modernized to a large extent than the previous system.

3.1.2 Acceptability of Quality of the Service

- i. Fig. 6 shows the public satisfaction level. About 45% respondents from the Contractor-B and 38% from Contractor-A service area said that SWM services are of good quality. They revealed that solid waste, at some places, was still collected from the house by the private crew member on donkey carts. Based on the selected Likert scale, the performance of both contractors, for this KPI falls in “average” category.
- ii. 49% respondents from Contractor-A and 41% of respondents from Contractor-B service area stated that SWM crew members demand money or any other perks for collection of solid waste from their area.
- iii. Almost all respondents suggested that, SWM contractor should provide solid waste collection bags; a practice adopted when these contractors initiated their services in Lahore.
- iv. 62% respondents from the Contractor-A area, and 42% from Contractor-B area stated that the capacities and number of storage bin are insufficient. They also stated that locations of the storage bins is inappropriate, i.e., is quite far from their houses. The odour nuisance from these bins was also reported at some places.
- v. 84% respondents from the Contractor-A area and 90% from the Contractor-B service area believed that women mobility/privacy is not affected due to the activities of SWM crew in their area. 58% of respondents from the Contractor-A area and 79% from Contractor-B area reported that the SWM crew mostly wear proper uniforms during working hours and their behavior is friendly with them.

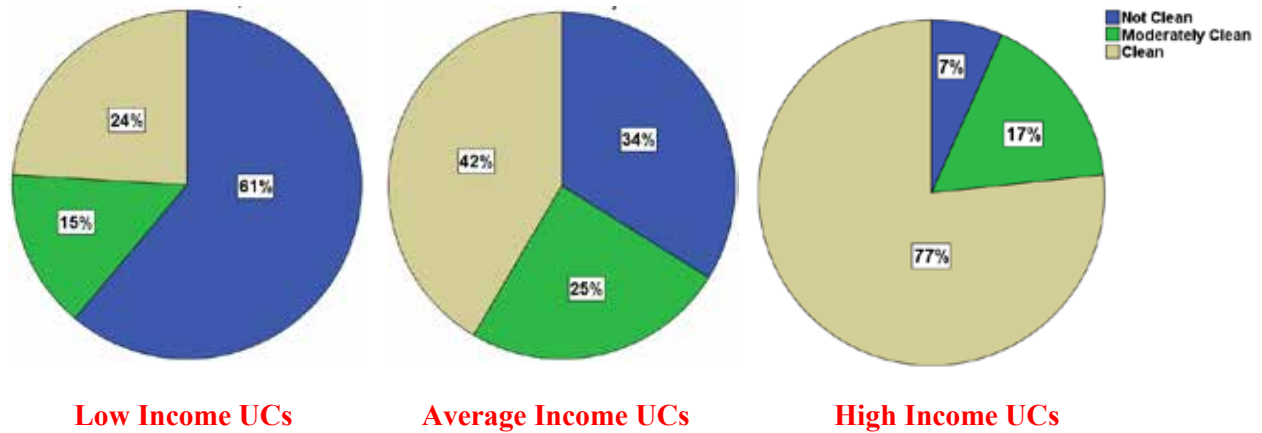


Fig. 5. Public satisfaction on income level basis in Contractor-A service area.

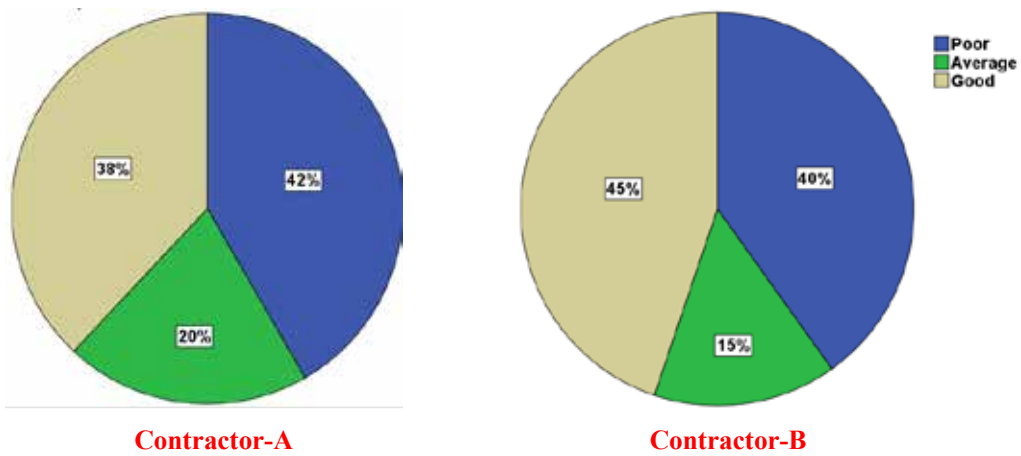


Fig. 6. Respondent views regarding the quality of SWM services.

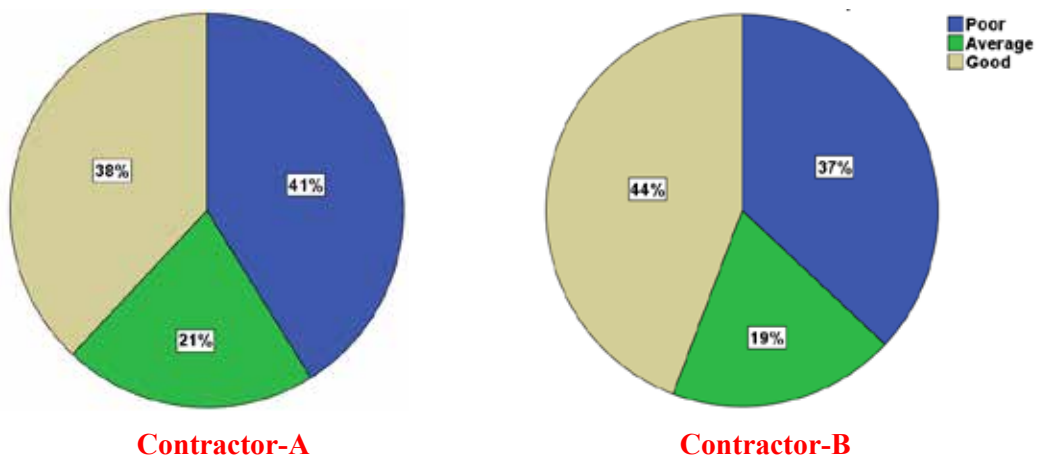


Fig. 7. Respondent views regarding the overall quality of customer care services.

3.1.3 Quality of Customer Service

- i. People's satisfaction with the quality of customer care services is presented in Fig. 7. It can be seen that 44% respondents from the Contractor-B area and 38% from Contractor-A area termed the quality of customer care center as "good", while the rest either termed it as "average" or "poor". Thus, the performance for this KPI for both the contractor was found to be "average".
- ii. A significant number of the respondents from the service areas of both the SWM contractors were found unaware regarding existence of any customer care services where complaints could be lodged.

3.2 Service Contractor's Competence Assessment Model

The findings based on interviews of the concerned officials are discussed in the following sections.

3.2.1 Public Awareness Plans

- i. Interviews revealed that no proper public awareness plan was formulated by both the SWM contractors. Only 29% concerned officials for Contractor-B and 18% for Contractor-A said that public awareness plan was formulated but no backup data were provided by any concerned official for the verification. Details of concerned official's views are presented in Fig. 8.

3.2.2 Operation Strategies and Practices

- i. The data analysis on this KPI is presented in Fig. 9. It is evident that about 82% concerned officials for Contractor-B and 71% for Contractor-A reported that good work operation strategies and practices have been adopted for SWM in the areas.
- ii. The concerned officials, for both the SWM contractors, told that proper route planning was made for the solid waste collection by the vehicle from the allotted area.
- iii. The route maps are provided to the drivers for the collection of solid waste in the area and daily log-books are also provided to the drivers for recording trajectory details.
- iv. There was a good system for the monitoring

and supervision of the SWM services. As per the information provided by concerned officials field visits are made by the Assistant Managers (AMs) and Zonal Officer (ZOs) of both SWM contractors in their allotted area, on daily basis.

- v. Both the SWM contractors are using the modern tools like GIS, GPS etc. for monitoring and central control. The android mobile phones equipped with GPS facility are provided to the all concerned AMs to track the collection vehicles.
- vi. The record of coordination of both SWM contractors were found with other concerned departments like WASA, LWMC, TEPA, etc. but it was limited to the office hours not on 24/7 basis.

3.2.3 Training of Employees

- i. The results of this KPI are shown in Fig. 10. About 71% concerned officials for Contractor-B and 35% for Contractor-A told that there is a practice of routine training of employees. However, no backup data was provided by both SWM contractors for the purpose of verification.

3.2.4 Protection of Public Health and the Environment

- i. The results of this KPI are shown in Fig. 11. About 85% officials of Contractor-B and 68% of Contractor-A told that Personal Protective Equipment's (PPEs), i.e., Gloves, hats, special shoes, masks, special uniform etc. were provided to the all crew members for SWM activities. However, most of the officials also highlighted that, SWM crew members do not use PPEs during routine SWM activities.

3.2.5 Equipment and Facilities owned by the SWM Contractors

- i. Results of this KPI are shown in Fig. 12. About 79% officials of Contractor-B and 71% of Contractor-A told that SWM contractors owned good equipment and facilities for SWM activities.
- ii. The officials of both SWM contractors told that vehicle and equipment, being used for the SWM activities are modern, reliable and consistent with the local condition.
- iii. The in-house maintenance workshop, for

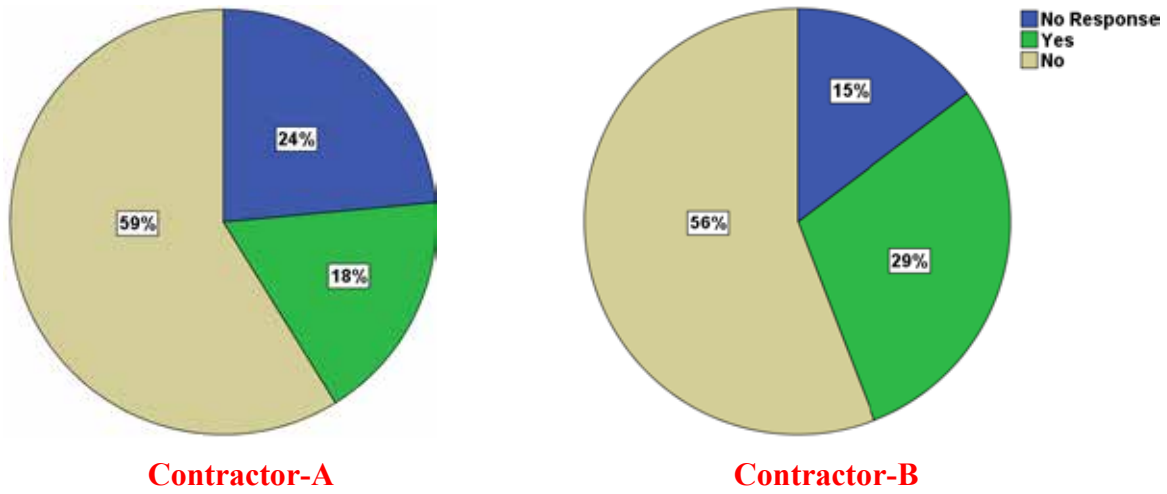


Fig. 8. Concerned officials views regarding the public awareness plans.

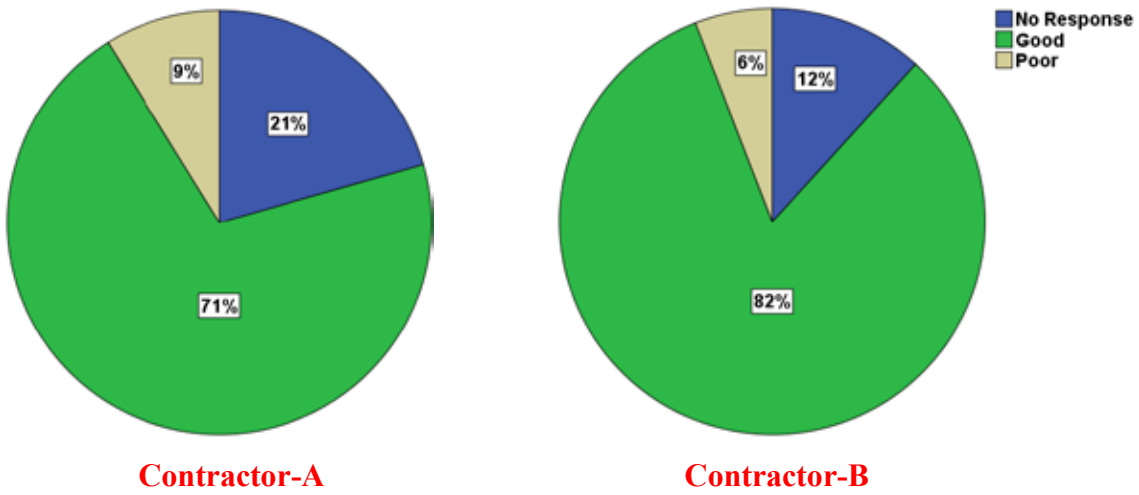


Fig. 9. Concerned officials views regarding the work operation strategies and practices.

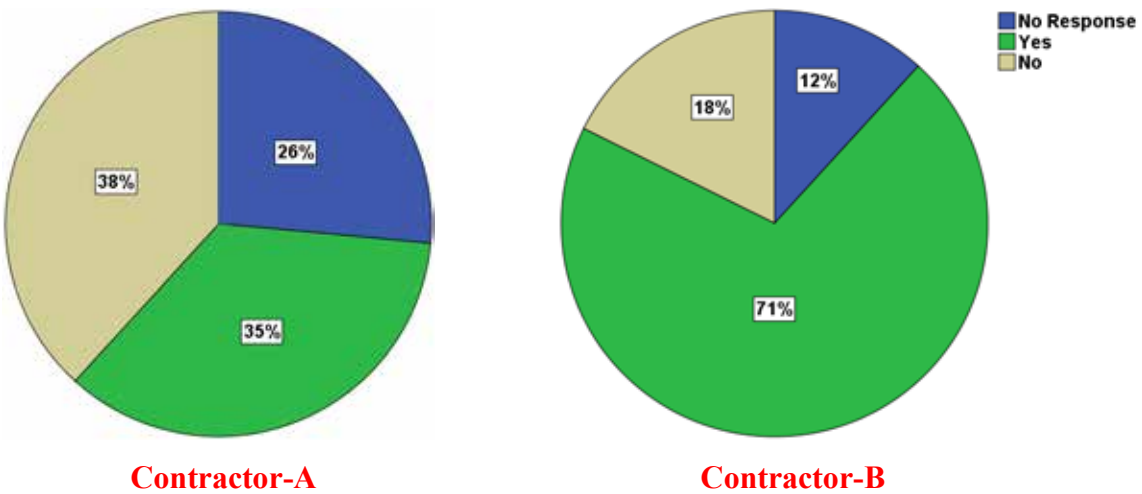


Fig. 10. Concerned officials views regarding the training of employees.

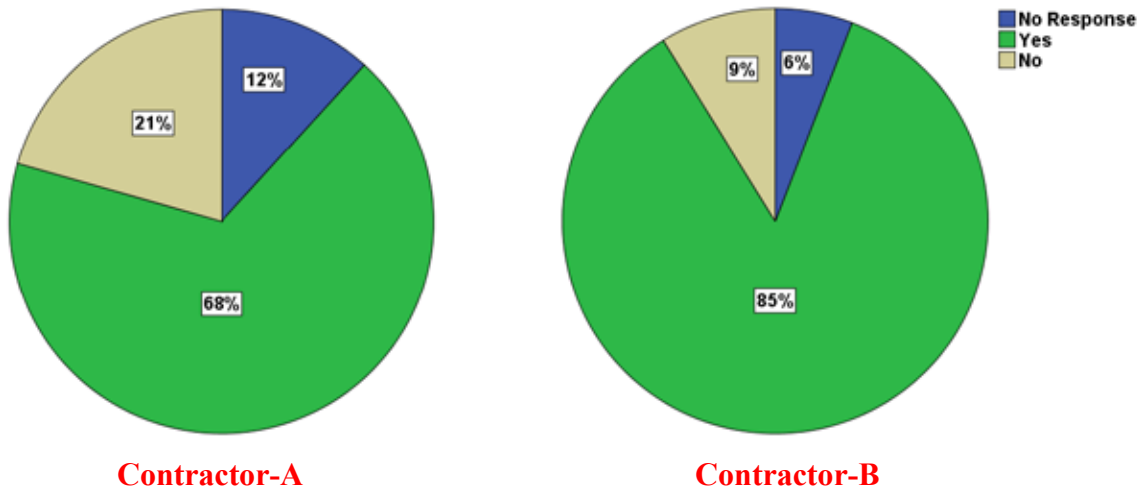


Fig. 11. Concerned officials views regarding the protection of public health and environment.

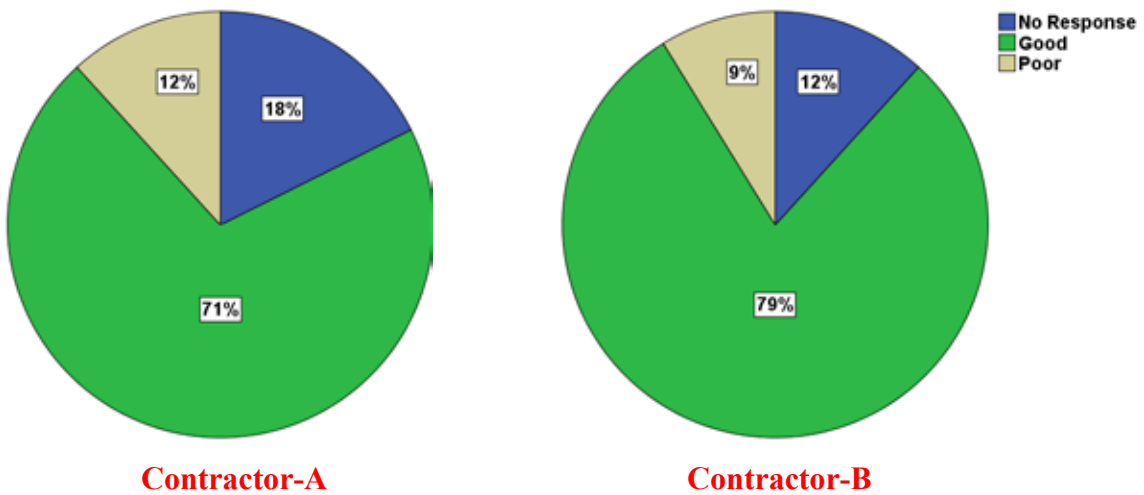


Fig. 12. Concerned official's views regarding the equipment and facilities owned by the SWM contractor.

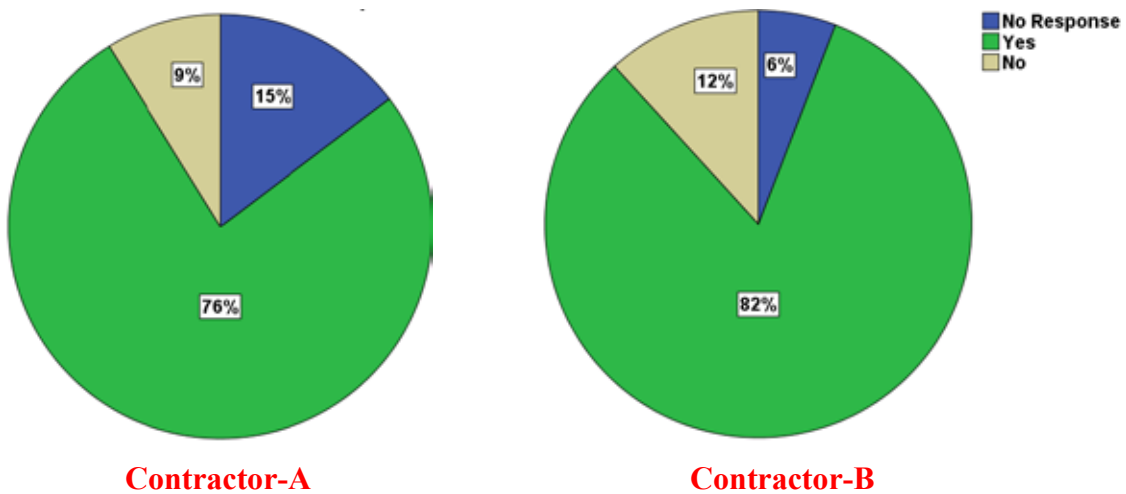


Fig. 13. Concerned officials views regarding the solid waste collected and disposed.

vehicles maintenance, was available with both SWM contractors. Contractor-A has two (02) vehicle maintenance workshops on Ferozpur Road. Contractor-B has three (03) workshops; one (01) on Multan Road near Chowk Yateem Khana, one (01) at Outfall Road and one (01) at Valencia Town. However, there was no maintenance schedule for the vehicles. Repairs were carried out only on the observation of any fault.

- iv. Officials of both the contractors reported that capacities and number of the solid waste storage containers and vehicles were almost sufficient. However, when the number of vehicles was compared with that given in the contract agreement of both contractors (Table 5), the above statement appeared to be wrong.

3.2.6 Solid Waste Collected and Disposed

- i. The results of this KPI are shown in Fig. 13. About 82% concerned officials of Contractor-B and 76% of Contractor-A told that solid waste is properly collected and disposed off.

There are five (05) main solid waste disposal sites in Lahore, i.e., (1) Mehmood Booti Dumping Site; (2) Baggrian Dumping Site; (3) Saggian Dumping Site; (4) Tibba Dumping Site; and (5) Lakho Dhair Landfill Site. Currently, both the contractors have no arrangements for waste recycling. All solid waste is dumped at the dump site without recycling, except at Lakho Dhair.

4. CONCLUSIONS AND RECOMMENDATIONS

Following main conclusions have been drawn on the basis of service beneficiary assessment model:

- (1) Almost 50 % of the service beneficiaries on average were unaware regarding the working of SWM contractor and procedure of filing complaints;
- (2) Public satisfaction regarding the cleanliness

was more in the high income areas as compare to low income areas;

- (3) Extent of cleanliness was better in the areas with better and wider roads;
- (4) In some areas private crew members are collecting waste through informal means like donkey carts;
- (5) Demand of money or other perks by SWM crew was also highlighted in certain areas;
- (6) Odour and nuisance from storage bins was reported at several places;
- (7) SWM crew mostly wear proper uniforms during working hours and their behaviour is friendly with public;
- (8) Women mobility/privacy is not affected due to the activities of SWM crew; and
- (9) Complaints regarding the quality of customer care services were raised by few respondents.

Main conclusions drawn on the basis of service contractor’s competence assessment model include:

- (1) No proper public awareness plan was formulated by both SWM contractors and even if they are prepared the public is not duly informed in this regard;
- (2) Proper rational route planning was done by both SWM contractors for solid waste collection;
- (3) Route maps for solid waste collection and daily log-books for recoding vehicle details were provided to the drivers;
- (4) Both SWM contractors were using modern tools for monitoring and centralcontrol;
- (5) No comprehensive training plan was formulated by both the SWM contractors;
- (6) PPEs were provided and used by the crew members;
- (7) Vehicles and equipment being used were modern, reliable and consistent with the local condition but number of vehicles being used was found less as compared to contract

Table 5. Number of vehicles: actually deployed and those written in the contract agreement.

Contractor-B		Contractor-B	
As per contract	Actually deployed	As per contract	Actually deployed
275	53	234	42

documents;

- (8) In-house maintenance workshop facility for vehicles maintenance was available for both SWM contractors; and
- (9) Recycling of waste is not being carried out by both the contractors. This task should be added in the terms of reference (ToRs) and should be carefully monitored by the LWMC.

The results of this study revealed that both the SWM contractors require improvements in all sectors. However, overall performance of Contractor-B is better in almost all sectors as compared to the Contractor-A.

Following recommendations are made to improve the situation: (1) Effective public awareness campaigns should be launched on large scale and necessary public disclosure of information should be done at all levels; (2) Distribution of solid waste collection bags should be re-started to ensure the better collection of solid waste; (3) Concerned officials should give more attention towards low and average income areas to ensure the cleanliness in addition with arranging suitable machinery that matches with the road width and increase the number of trips of solid waste collection vehicles; (4) The concerned officials should increase their field visit to minimize the complaints regarding the uncleanliness and money demand by the SWM crew members; (5) Capacities and number of storage bins should be increased as per actual demand and should be placed at appropriate locations; (6) Preventive measures should be ensured to stop the odour and nuisance from the storage bins; (7) Both SWM contractors should introduce the reforms to improve quality of their customer care services e.g. online customer service facility. Currently, LWMC is running a website that only provides generic information with less importance given to customer service delivery information and guidance. This online facility can be redesigned to improve the connectivity between the customer and the contractors; (8) The complaint redress data base should be used in optimization of resources and decision making; (9) Comprehensive training plan should be formulated for workers and officials; (10) Number of vehicle and equipment should be increased as per contract documents for material recovery in existing transfer stations can help in start-up of the recycling process; and (11) LWMC may think in terms of formalizing the role

of scavengers and integrate them in their system and use them as its workforce in recycling activities; many such examples exist in other countries [22-30].

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6. REFERENCES

1. Muneera, M.N.F. *Public-Private Partnership (PPP) in Solid Waste Management: Literature Review of Experiences from Developing Countries with Special Attention to Sri Lanka*. Accessible at: www.diva-portal.org/smash/get/diva2:617746/fulltext01.pdf (2012).
2. LDA. *Terms of Reference for Preparation of Integrated Strategic Development Plan for Lahore Region 2035*. Accessible at: www.urbanunit.gov.pk/ISDP/TORs%20LAHORE%20LDA_ISDP35_July12-2012pdf (2012).
3. Asim, M., S.A. Batool, & M.N. Chaudhry. Scavengers and their role in the recycling of waste in southwestern Lahore. *Resources, Conservation and Recycling* 58: 152-162 (2012).
4. Joeng, H. & K. Kim. *KOICA-World Bank Joint Study on Solid Waste Management in Punjab, Pakistan*. Waste Management, Pakistan, www.urbanunit.gov.pk/PublicationDocs/22.pdf (2007).
5. Nadeem. City Government leaves Lahore in a mess. In: *Weekly Pulse*, Islamabad (2013).
6. Rathi, S. Alternative approaches for better municipal solid waste management in Mumbai, India. *Waste Management* 26(10): 1192-200 (2006).
7. S. Esakku, A.S., O. Parthiba & K. Palanivelu. Municipal solid waste management in Chennai city, India. In: *Proceedings Sardinia, 11th International Waste Management and Landfill Symposium*, CISA, Environmental Sanitary Engineering Centre, Cagliari, Italy (2007).
8. Furniturwala, I. Setting the trend in waste management; a story from India. In: *Waste: The Challenges Facing Developing Countries*. http://www.proparco.fr/jahia/webdav/site/proparco/shared/PORTAILS/Secteur_prive_developpement/PDF/SPD15/SPD15_Irfan_furniturwala_uk.pdf
9. Mbuligwe, S.E. Assessment of performance of solid

- waste management contractors: a simple techno-social model and its application. *Waste Management* 24(7): 739-749 (2012).
10. Vigderhous, G. The Level of Measurement and 'Permissible' Statistical Analysis in Social Research. *Pacific Sociological Review* 20(1): 61-72 (1996).
 11. Vigderhous, G. The level of measurement and 'permissible' statistical analysis in social research. *Pacific Sociological Review* 20(1): 61-72 (1997).
 12. Jakobsson, U. Statistical presentation and analysis of ordinal data in nursing research. *Scandinavian Journal of Caring Sciences* 18: 437-440(2004).
 13. Likert, R. A technique for the measurement of attitudes. *Archives of Psychology* 40: 55 (1932).
 14. Nunnally, J.C. *Psychometric Theory*. McGraw Hill, USA (1978).
 15. Clason, D.L., & T.J. Dormody. Analyzing data measured by individual Likert-type items. *Journal of Agricultural Education* 35(4). <http://pubs.aged.tamu.edu/jae/pdf/vol35/35-04-31.pdf> (1994)
 16. Jacoby, J. and Michael S. Matell, Three-point Likert scales are good enough. *Journal of Marketing Research* 8(4): 495-500 (1971).
 17. Jamieson, S., Likert scales: How to (ab)use them. *Medical Education* 38(12): 1217-1218 (2004).
 18. Singh, N., S. Sood, & V. Kapse. *Sampling Techniques: Systematic and Purposive Sampling (a presentation)* (2014) Accessible at: <http://www.slideshare.net/siddhisood/sampling-techniques-systematic-purposive-sampling-42896131>
 19. Engineerings, A.C. *Union Councils Profile: Lahore*, 144 pp. (2013).
 20. Population Census Organization, G.O.P. *1998 Census Report, Pakistan* (1998).
 21. Systems, C.R. *Sample Size Calculator*. Accessible at: <http://www.surveysystem.com/sscalc.htm> (1998).
 22. IBM. *SPSS Software*. Accessible at: <http://www-01.ibm.com/software/analytics/spss/> (1998).
 23. Adan, B., V. Cruz and M. Palaypay. Scavenging in Metro Manila. Manila, Philippines. *Report Prepared for Task 11* (1982).
 24. Semb, T. Solid Waste Management Plan for the Suez Canal Region, Egypt, In: *Recycling in Developing Countries*, Thome-Kozmiensk, K. (Ed.). Freitag, Berlin, p. 77-81(1982).
 25. Blincow, M. Scavengers and recycling: A neglected domain of production. *Labour, Capital and Society* 19: 94-115 (1986).
 26. Meyer, G. *Waste Recycling as a Livelihood in the Informal Sector- The Example of Refuse Collectors in Cairo*. *Applied Geography and Development* 30: 78-94 (1987).
 27. Baldismo, J. Scavenging of municipal solid Waste in Bangkok, Jakarta and Manila. *Sanitation Reviews, Asian Institute of Technology, Bangkok*: 26 (1988).
 28. Mediana, M. Informal recycling and collection of solid waste in developing countries: issues and opportunities, In: *Environmental Sanitation Reviews*, Asian Institute of Technology, Bangkok; United Nations, Institute of Advanced Studies (1997).
 29. Medina, M. Scavenger cooperatives in developing countries. *BioCycle*: 70-72 (1998).
 30. Median, M. Scavenger cooperatives in Asia and Latin America. *Resources, Conservation and Recycling* 31: 51-69 (2000).