



# Challenges in household solid waste separation plan (HSWSP) at source: a qualitative study in Iran

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## Abstract

Identifying the challenges in source separation of waste in different communities may lead to better understanding on the potential outcomes of recycling programs. Our goal in this study was to identify the challenges of conducting household solid waste separation plan (HSWSP) at source in Tabriz metropolitan city, Iran. In this qualitative study, fourteen key informants on HSWSP at source were interviewed. Content analysis with conventional approach was used to analyze the data. MAXQDA<sub>10</sub> was applied to organize the data, to categorize the codes and to identify the relationships between the concepts. Six core categories were identified as the main challenges in the HSWSP at source: (a) low level of participation among citizens; (b) garbage robbery; (c) unbalanced resources; (d) weakness in policymaking; (e) poor performance of private sector; and (f) lack of integrated management. Considering the six challenges identified as hindrances to the successful implementation of HSWSP at source, policymaking was found to connect all the challenges; thus, this work recommends the key authorities and HSWSP at source policymakers to consider revision of the recycling programs plan with appropriate focus on policy development. The work also recommends an integrated approach that will be unified across the city as well as flexible to incorporate variations at various regions of the city.

**Keywords** Household solid waste separation · Waste management · Garbage

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## 1 Introduction

Developing countries are faced with an increasing rate of population growth and industrial development, which may in turn result in producing huge amounts of solid waste, particularly in the fast-growing cities (Akhta et al. 2017). In many developing countries, municipal solid waste management is inefficient as a result of various factors like limited resources, lack of cooperation between organizations (Hazra and Sudha 2009), population growth and urbanization, poor management, lack of financial resources and lack of technical skills among municipal officials (Damghani et al. 2008). In such countries, therefore, the disposal and management of waste have rapidly been identified as a social and environmental concern (Marshall and Khosrow 2013). Inappropriate management of municipal solid waste may result in many serious negative consequences including air pollution, loss of aesthetic values and economic losses (Damghani et al. 2008), and hygienic problems like transmission of diseases (Mohammed and Elias 2017).

Waste management may be applied through several procedures such as incineration, landfilling, energy production and recycling. Currently, the sustainable recycling methods and reusing waste have been recommended as efficient methods. These methods not only reduce the amount of waste and prevent further contamination of environment, but also help the managers in saving cost, energy and natural resources (Asase et al. 2009).

Although source separation of waste is a common way to separate the recyclable fractions, effective participation of inhabitants is also required to promote the correct sorting of recyclable materials and food waste (Rousta and Dahlén 2015). Krook et al. (2007) reported that the success of household recycling programs is strongly depended to the citizens' participation in the source separation process.

In many developing countries only about 10% of the municipal solid waste are recycled (Rousta et al. 2015). In contrast, in developed countries, like Sweden, approximately 33% of municipal solid waste are recycled (Swedish Waste Management Association 2014). A significant factor in successful implementation of waste recycling plans in developed countries is active participation of citizens (Rada et al. 2013). As other contributing factors, attitudes toward recycling, environmental concern (Martin et al. 2006) and convenient access to recycling facilities (Dahlén et al. 2009; Refsgaard and Magnussen 2009) are reported, as well.

In a previous Iranian study, the inefficiency in source separation of waste plans was reported as the reason for insignificant amount of recycled municipal solid waste (Damghani et al. 2008). As reported by other Iranian studies, such an inefficiency in the plans may be due to the lack of participation among citizens, poor participation of private sector, inappropriateness of the collection systems and institutional problems at the waste management level—like the high cost of collection systems (Ahmadi et al. 2013; Fahiminia et al. 2013).

In the past few years, the amount of solid waste generated in different urban areas of Tabriz, Iran, was reported to be 900–1200 tons per day. The content of organic materials, paper and cardboard and recyclable materials (plastic, metal, glass, etc.) in Tabriz solid waste was also reported to be 52, 13.15 and 19%, respectively. In 2013, the rate of waste generation in Tabriz was estimated to be 0.89 kg/person/day (Zazouli et al. 2013), which was comparable to those reported in other metropolitan cities of Iran such as Tehran (Hassanvand et al. 2008) and Rasht (Alavi Moghadam et al. 2009). According to the waste management law in Iran, municipality of each city is responsible for managing all wastes of urban and rural areas, excluding the industrial and special wastes (Islamic

Parliament 2004). The municipalities have delegated the urban and rural waste management responsibilities to Municipality Waste Management Organization (MWMO) and Rural Governorate Organization, respectively. So, the main responsibility of MWMO in Tabriz is to collect and landfill the urban solid waste, only. Beside this task, this organization has two other responsibilities, including source separation of waste for recycling and establishment of a composting facility. The household solid waste separation plan at source (HSWSP at source) was a plan initiated by MWMO in 2006 throughout Tabriz metropolitan city (Tabriz Municipality 2010). This plan aimed to collect the household recyclable waste (including plastic, bottles, paper, glass and all types of metals), separated by the residents—as the source of separation. In order to implement the plan, the MWMO, as the executive agency for managing Tabriz solid waste, signed a 16-year contract with an organization from private sector. According to this contract, the private sector was responsible to collect the separated waste from all around the city. The responsibility of the MWMO was to provide the private sector with financial resources and necessary facilities and to train the citizens on how to separate the waste. Based on the objectives of the program, a series of trained educators had face-to-face visits to the citizens' houses and provided the inhabitants with educational leaflets. The educators also distributed free special yellow-colored bags between the citizens of each region to help them in source separation of wet and dry waste. The citizens, thus, had to put the separated solid waste into particular cans situated in special places throughout the city. The piled-up solid waste in the cans was collected twice a week (on Mondays and Fridays), applying truck vehicles particularly designed to collect dry and wet waste. After collection, the source separated solid waste was transferred into the recycling stations, established to separate different types of waste (paper, glass, plastic, etc.). The separated materials in the recycling stations were, then, transferred into recycling plants. The materials like polyethylene terephthalate (PET) bottles were exported to overseas. Other plastic materials, after melting, were reused to produce plastic material appliances. The non-recyclable materials were also landfilled.

In order to improve the implementation process of HSWSP at source, the MWMO has performed various measures including public education through mass media, students' education at schools as well as designation and installation of particular cans for separated dry and wet wastes in some areas of the city. Despite all funds invested in the project, there are still large gaps between the current status of HSWSP at source and what was considered as final goals of the project. For instance, over 250 million kilograms of recyclable materials in the city are still landfilled (Harati 2010). Such a failure in project has not only caused a great loss in the national capital, but also resulted in further destruction and pollution of the environment. The aim of the present qualitative study was to identify the challenges of implementing HSWSP at source from the viewpoints of waste management key informants in Tabriz, Iran.

## 2 Materials and methods

### 2.1 Study area

Tabriz (38°4'35.76"N, 46°16'48"E) is the largest city and the capital of East Azerbaijan Province, Iran. According to the recent national census, in 2016, the population of Tabriz was 1,773,033 (Statistical Center of Iran 2016). Most citizens in Tabriz are overwhelmingly Azerbaijani and speak in Turkish language, though Persian is spoken as the second

language. Tabriz is one of the most developed cities of Iran and is also an economic, industrial, tourism and commercial polar of the country. Heavy manufacturing industries such as automobile and tractor manufacturing, oil and gas, petrochemicals and refinery industries as well as food, textile, carpet, leather and confectionery industries are the main economic activities of people in Tabriz.

## 2.2 Participants and sampling procedures

This was a qualitative study with conventional content analysis approach carried out from April to June 2017 in Tabriz, Iran. Our aim was to explore the challenges of implementing HSWSP at source. Applying purposeful sampling, fourteen key informants including six members of the MWMO, two environmental health specialists, three individuals from private organizations and three employees with executive experiences in the MWMO and employed in Tabriz municipality were invited to participate in the study. All participants were interviewed face to face. More details about the participants are presented in Table 1. Inclusion criteria for the study were to be considered as key informant in the HSWSP at source and willingness to participate in the study.

## 2.3 Interview procedure

Face-to-face semi-structured interviews were used to collect data. A primary open-ended question, “how would you explain the obstacles and problems of conducting the HSWSP at source in Tabriz?” was used to initiate each interview, which was, then, followed by probing questions like:

1. Based on your viewpoint, how do citizens participate in the process of waste separation?
2. How do you explain the private sector’s performance in the field of waste separation plan at source?
3. How is the performance of the waste management organization in the field of waste separation plan at source?

The time and place of the interviews were determined based on the participants’ preferences. So, the interviews were conducted in the participants’ offices. Each participant was interviewed once. The interviews lasted 26–60 min, and all interviews were audiotaped. Before interviews, the participants were permitted to audiotape their voices.

## 2.4 Data analysis

During data collection process, data analysis was performed, concurrently. In qualitative studies, the research team should be involved into the analysis process throughout the study. So, they can increasingly focus on gathering the data, developing the topics and elaborating the developed themes (Saint et al. 2008). Qualitative content analysis was used to analyze the data. All audiotaped interviews were transcribed verbatim, and the interviews were read and reread, several times. Data analysis was started with identifying the units of meaning extracted from the participants’ statements. The codes were generated inductively and the extracted codes were identified as categories, based on the differences and the similarities.

**Table 1** Characteristics of the study participants

Participant no.	Gender	Age	Responsibility	Marital status	Level of education
P1	Female	38	Executive experience in HSWSP at source and employed in Tabriz municipality	Married	M.Sc.
P2	Female	41	Employed in MWMO	Married	M.Sc.
P3	Male	45	Employed in MWMO	Married	M.Sc.
P4	Male	38	Specialist in waste management	Married	Ph.D.
P5	Male	30	Employed in private sector	Single	Under Diploma
P6	Male	49	Specialist in waste management	Married	Ph.D.
P7	Male	39	Employed in MWMO	Married	M.Sc.
P8	Male	38	Employed in private sector	Married	Bachelor
P9	Male	52	Employed in private sector	Married	Elementary
P10	Female	43	Executive experience in HSWSP at source and employed in Tabriz municipality	Married	Ph.D.
P11	Male	32	Employed in MWMO	Married	Bachelor
P12	Male	47	Employed in MWMO	Married	Ph.D.
P13	Female	37	Executive experience in HSWSP at source	Married	M.Sc.
P14	Male	51	Executive experience in HSWSP at source and employed in Tabriz municipality	Married	Ph.D.

Data analysis continued until data saturation, when no new theme or idea emerged. The qualitative data analysis software MAXQDA<sub>10</sub> was applied to facilitate the organization of coding process and to categorize the codes and to identify the relationships between concepts.

## 2.5 Data trustworthiness

In order to promote the credibility of the study and to verify the preliminary findings from the earlier interviews, prolonged engagement with the participants was ensured. The research team members, as experts, conducted peer checking (member check). Also, sampling with maximum variation approach enhanced the confirmability and credibility of the data.

## 2.6 Ethical considerations

Ethical approval to perform the study was obtained from Ethics Committee in Tabriz University of Medical Sciences (Ethical Code/Number, IR.TBZMED.REC. 1395.864). Before the interviews, the purpose of study was described to the participants and consent form was signed by both the participants and the researchers involved in the interview.

## 3 Results

After data analysis, six main categories were identified as the challenges to implement the HSWSP at source: “*low level of participation among citizens*,” “*garbage robbery*,” “*unbalanced resources*,” “*weakness in policymaking for HSWSP at source*,” “*poor performance of the private sector*” and “*lack of integrated management*.” Each category and the subcategories (Table 2) are described as follows:

### 3.1 Low level of participation among citizens

This challenge means that the citizens did not participate well in the source separation of dry and wet wastes. Low level of participation among citizens in the community may have led to the loss of costs invested by the management team. This theme is described below with two subcategories: “*lack of responsibility among citizens*” and “*loss of trust among citizens*”:

#### 3.1.1 Lack of responsibility among citizens

According to the participants’ opinions, waste separation at home is not considered as an important task by the citizens. This issue has resulted in tough problems for the executors to implement the program. In this regard, one of the participants (P1) explained that: “*citizens do not much care about garbage; this makes the implementation of waste separation difficult*.” Another participant (P5) said: “*citizens are careless about garbage and the environment which is our main concern*.” According to the participants’ beliefs, the citizens do not commit themselves to separate their waste. For instance, one of the participants (P2) stated: “*unfortunately,*

**Table 2** Identified challenges for complying with the waste separation at source program ( $n = 14$ )

Themes	Subcategories
Low level of participation among citizens	Lack of responsibility among citizens Loss of trust among citizens
Garbage robbery	Collection of dry waste by garbage thieves Illegal separation of dry wastes by municipal workers
Unbalanced resources	Improper use of expert personnel Allocating inadequate budget Regional discrimination in the HSWSP at source equipment
Weakness in policymaking for HSWSP at source	Lack of priority giving to HSWSP at source Lack of public education and informing Lacks in supporting the private sector and poor description of job scope Lack of internal/external coordination
Poor performance of the private sector	Lack of commitment among contractors to implement HSWSP at source Contractor's weakness in gaining profit from HSWSP at source Lack of coherent planning for HSWSP at source
Lack of integrated management	Lack of a municipal integrated management system for HSWSP at source

*the citizens do not pay attention to separate their wastes; you can rarely find a citizen who feels completely responsible about waste separation.”*

### 3.1.2 Loss of trust among citizens

The participants believed that some citizens have lost their trust in the waste separation project due to the neglect of environment health workers and/or urban contractors. As a confirmation for this issue, one of the participants (P7) stated: *“the citizens are discouraged. They say, they’re mocking us, every day they do something, some days they come to gather garbage, the next day they don’t. The workers do not regularly collect dry wastes. According to the program, workers should collect dry wastes and check the boxes twice a week, but they sometimes neglect. The result is the fact that people would be distrustful and may say “they are mocking us.”* Another participant (P5) said: *“there is a sense of distrust among citizens in the area of waste separation. For example, we have distributed educational materials in different areas and we asked the people to separate their wastes. The citizens separated their waste but the poor response of the collecting agents has been translated as irresponsibility on the side of the waste management agents thus the trust of citizens has declined with time. The workers did not go timely to collect the separated waste and they were stacked together. When citizens become distrustful in such situations, no matter how hard we have tried, it would be too difficult to have their trust back like as it was in the beginning of the program.”*

### 3.2 Garbage robbery

Based on the perspectives of the participants, a major problem in the HSWSP at source was garbage robbery. This challenge means that the citizens' separated waste is collected

by the individuals other than the workers of the contracted private sector. A part of the revenue for the MWMO and the private contractors is achieved by selling the segregated solid waste, and so, the interference of unauthorized collectors may have a negative impact on the investment of stakeholders. This problem may demotivate the workers of private sector to timely collect the waste, which may, in turn, hinder the motivation of citizens to source separate the waste. This category was explained in two subcategories: “*collection of dry wastes by garbage thieves*” and “*illegal separation of dry wastes by municipal workers*.”

### 3.2.1 Collection of dry waste by garbage thieves

The participants believed that there were unauthorized collectors in the city, who steal dry wastes from the bins. In this regard, a participant (P8) said: “*one of our main problems is the garbage thieves who collect dry wastes from the bins; they must be stopped. The revenue of the private sector contractors is through the collection of dry wastes. The unauthorized collectors cause financial damage to the private sector and, as a result, they may interrupt the implementation of program*.” Another participant (P2) said: “*there are unauthorized individuals at the city who collect and sell the wastes like papers and/or plastics, while the contractors should collect and sell the dry waste. In fact, a part of their profits is achieved by selling the separated waste*.”

### 3.2.2 Illegal separation of dry wastes by municipal workers

According to the participants’ opinions, the separated wastes are collected by both the unauthorized collectors, and the urban municipality workers responsible for collecting solid/mixed (solid and wet) wastes. In this regard, a participant (P8) said: “*the municipal workers separate the separated dry wastes when collecting garbage from the streets, each one hanging out a bag from a garbage car, and looking for dry wastes*.” Another participant (P5) said: “*unfortunately, some municipal workers who should only collect wet waste are also trying to take separated solid waste from waste separation boxes. It is illegal for them to do. The solid wastes should be collected by the private-sector workers*.”

## 3.3 Unbalanced resources

Unbalanced resources may be defined as the lack of suitable infrastructures in the MWMO to implement the HSWSP at source, effectively. The participants believed on the lack of facilities and the improper use of expert personnel as the major problems in implementing HSWSP at source. Unbalanced resources are explained in the following three subcategories:

### 3.3.1 Improper use of expert personnel

The participants believed that the employees and the employers working at the management and executive departments of HSWSP at source were unable to properly execute the program, due to their lack of scientific expertise in the field. One of the participants (P4) said, “*waste separation officials do not have the required expertise; they do not think properly and do not make the right decision*.” Moreover, the participants believed that the contractors and the investors did not have the necessary expertise to properly execute the project. Confirming this issue, one of the participants (P10) said: “*the main problem here*

is that the investor company does not has expertise in proper waste management. If a company with related proper expertise in waste management is offered the responsibility of waste management in the cities, things would work well.” Another participant (P8) said: “the company has not been successful in implementing the program. I think the main reason is that the company has not the specialty in managing the wastes.”

### 3.3.2 Allocating inadequate budget

The participants announced that the MWMO does not have the financial ability to provide equipment and to pay the workers’ wages. A participant said (P3): “we started the implementation of waste separation plan at source in some regions after employing several workers and renting few cars. Within 4–5 months, we collected 40 tons of dry wastes, but due to not paying the costs of the rented cars by the MWMO, the project output/success declined after 4–5 months and is now almost half closed.” Another participant (P10) said: “the budget allocated to the implementation of plan is very low. This problem inhibited successful implementation of the project in all areas of the city; we cannot, for example, provide the necessary equipment to separate the waste.”

### 3.3.3 Regional discrimination in the HSWSP at source equipment

Selective provision of equipment at different parts of the city constituted a major challenge to successful implementation of HSWSP at source. Many participants believed that the well-off neighborhoods in the city were more provided with the facilities of HSWSP at source, compared to the poor regions. In this regard, one of the participants (P6) said: “the rich neighborhoods are provided with more facilities. They think that people’s cooperation is more in those regions, and they also presume more dry wastes like glass and paper in the prosperous regions.” Another participant (P3) said: “in some urban areas, waste disposal boxes are more prominent than other areas of the city. Poorer areas have less number of boxes. Some of the areas do not have even a separation box.”

## 3.4 Weakness in policymaking for HSWSP at source

Weakness in policymaking reflects poor legislations in the MWMO to implement the HSWSP at source. Participants’ statements indicated that the organization responsible for HSWSP at source does not have strong policies to implement the program successfully. Some of the identified policy-related concerns are presented in subsections below:

### 3.4.1 Lack of priority giving to HSWSP at source

Based on the participants’ statements, compared to other waste management activities, the HSWSP is not given a high priority by the managers. One of the participants (P4) said: “instead of investing and paying attention to waste separation at source, our authorities are going to buy a centralized waste incinerator, which I think is completely wrong. If the authorities are paying attention to the waste disposal infrastructures, its benefits are greater than the purchase of a waste incinerator device.” Another participant (P1) said: “I think the waste separation plan is not among the main priorities of the managers in the waste management organization. Instead of spending the budget on the plan, they are going to buy a waste incinerator.”

### 3.4.2 Lack of public education and informing

Most of the participants believed that the MWMO managers performed poorly in the design and the implementation of the public education, awareness and orientation on sustainable waste management of HSWSP at source. In this regard, a participant (P14) said: *“the amount of information provided by the municipality is not adequate, sufficient information has not been given about the wastes separation plan.”* Another participant (P6) said: *“the Waste Management Organization has been working poorly in community information and education, with only a limited series of education in residential schools and residential complexes. The municipality can introduce the plan to people through urban billboards and inform about the benefits of waste separation. Such efforts has been done, but not at a large scale.”*

### 3.4.3 Lacks in supporting the private sector and poor description of job scope

Some of the participants have the belief that investors were not properly supported by MWMO which constitute challenges to the proper implementation of HSWSP at source. *“The municipality did agree with signing new contracts to establish new recycling factories, but there are now individuals who have established recycling factories under the license of the municipality,”* said a participant (P8). Majority of the participants inferred that the planned HSWSP at source will not be successful due to the incompetency and lack of transparency in the contracts with private sector. For example, a participant (P13) stated: *“a contract was offered which was rudimentary. So, the investor may not be willing to execute it completely, and to fulfill its obligations.”* Another participant (P1) said: *“the Waste Management Organization contract with the contractor is not comprehensive. In the contract, the tasks of the contractor are not clear. This contract is now one of the main managerial problems in the Waste Management Organization; because the contractor does not perform the tasks well. In the contract, there is no specification on what to do if the contractor did not perform his tasks well.”*

### 3.4.4 Lack of internal/external coordination

Another problem that participants described as a major challenge to successful implementation of HSWSP at source was the lack of inter-organizational and intra-organizational coordination and proper lines of communication. Confirming this issue, a participant (P2) said, *“the interaction between stakeholders, such as the department of environment and the waste management organization, is an important issue, they do not cooperate with us.”* Another participant (P8) also agreed that there were several inconsistencies within the MWMO, and stated *“nowadays, the recycling stations of the private sector are getting closed one after another; the officials of the Waste Management Organization said that the workers of recycling stations were not elected by them.”*

### 3.5 Poor performance of the private sector

Another challenge was the inefficiency and poor technical knowledge of the private sector to implement the HSWSP at source, effectively. The weaknesses of the private sector

are at the different stages of program implementation, which may be explained by the following three subcategories:

### **3.5.1 Lack of contractors' commitment to implement the HSWSP at source**

According to the participants' opinions, the private sector is not capable to collect the separated wastes of citizens. In this regard, one of the participants (P7) believed: *"we cannot control the process; we have two separation boxes which cannot be collected properly."*

### **3.5.2 Contractor's weakness in gaining profit from the HSWSP at source**

Participants' statements indicated that the investor company cannot make revenue from the waste separation program. Confirming this issue, a participant (P2) said, *"we have to think about the benefits of this project, they are not able to make profit from this dirty gold."*

### **3.5.3 Lack of coherent planning to implement the HSWSP at source**

Based on the participants' viewpoints, a main reason for the lacks in the project was incoherent planning to implement the program and the lack of novel works to collect the separated waste by the private companies. A participant (P12) said *"they are imitating each other and perform everything they hear, they have no plans for the future; it is not clear what they want to do."* Another participant (P9) stated: *"the investor has no principal plan to implement the waste separation program in the future. They do not know what to do. The contractor should has a plan to be able to do his job well. How can they use the separated waste and how can they improve the waste separation program, when they do not have a properly structured program?"*.

## **3.6 Lack of integrity in the management system**

Our findings indicated that the municipalities of different urban areas in Tabriz do not have a unique and coordinated management system to implement the HSWSP at source. An integrated municipal management system may be effective in optimizing the management of executive activities and in involving various stakeholders in the designed programs. However, the participants introduced the lack of integrated management system of the urban projects, including HSWSP at source, as one of the most important challenges. This theme can be expressed as the lack of integrity in the management system of the HSWSP at source.

With reference to the above-mentioned theme, the participants believed that the HSWSP at source was poorly implemented in different parts of the city which can be attributed to the lack of integrity in the urban management system. One of the participants (P13) said: *"each of the regions implement the program as they want. Each region has its own management system. You see one region that executes the program, and one that do not."* Another participant (P12) said: *"one of our major problems in implementing waste separation is the lack of an integrated system to manage urban programs. The Waste Management Organization has the same program for implementing waste separation in all urban areas. However, since the management system in our area is not integrated, the municipalities of each region implement their plans according to their own manner."*

## 4 Discussions

In the present qualitative study, we identified various challenges in the implementation of HSWSP at source. Despite numerous challenges, the plan is still ongoing in the city, which may be due to the lack of robust alternative programs for the plan. In addition, no evaluation study has, so far, been conducted on the effectiveness and/or challenges of the plan. Therefore, the limitations of the program have remained unclear till now. Our present study was the first research conducted to identify the challenges of HSWSP at source in Tabriz. The challenges were categorized in the following themes: low level of participation among citizens, garbage robbery, unbalanced resources, weakness in policymaking for HSWSP at source, poor performance of the private sector and lack of integrity in the urban management system.

Our results showed that the recyclable wastes were stolen and sold by garbage robbers and sometimes by urban waste collectors in the process of collecting garbage, or even before the garbage collection process. This problem was also shown in other developing countries (Matter et al. 2013; Linzner and Salhofer 2014; D'Amato et al. 2015). Linzner and Salhofer (2014), in a study conducted in China, reported that a significant proportion of the recyclable materials are collected by unauthorized collectors. In another study conducted by Wilson et al. (2009), the rate of waste recycling performed by informal sectors in developing countries was 20–50%. Although collecting garbage by unauthorized individuals may have a negative impact on the waste collection officials and recyclers, organizing these people in the program may have a positive impact on the recycling process and consequently on the economy of societies and urban environment, as well (Ezeah et al. 2013; Umair et al. 2015). It seems that the presence of unauthorized collectors in the waste collection system of developing countries is a major challenge for the officials in the associated organizations. These organizations should consider this seemingly threat as an opportunity, as they can organize the unauthorized recyclers and integrate them into their official organization. Thus, it is recommended to the MWMO stakeholders to organize the unauthorized waste collectors in the form of their own man forces with the hope to align their activities to the goals of the organization.

A basis for the problems in waste management system of developing countries is lack of policymaking (Chen et al. 2010; Tang 2014). Executive organizations can adopt proper policies to improve the waste collection management process. Similar to our findings, Chen et al. (2010) in China reported the lack of proper policies and regulations as the major problems and challenges facing the urban solid waste management. In another study, Tang (2014) recommended that government authorities should promote HSWSP policies through applying some measures like establishing compulsory retraining programs on HSWSP at source for the policymakers. In Malaysia, Moh and Manaf (2014) after studying the policies of solid wastes found the lack of clear policies as main problems facing municipal solid waste management. Despite the problems exist in the HSWSP policymaking, it is possible to revisit and strengthen the policies and regulations of wastes separation using strategies like advocacy. Studies in the different fields of healthcare systems have shown advocacy as a helpful strategy in improving policies to achieve the goals of a successful program (Goodkind 2005; Babazadeh et al. 2017). Babazadeh et al. (2017) in Iran showed that changing and strengthening policies and regulations through advocacy may improve the performance of health promoting schools. Therefore, key beneficiary organizations and authorities may help the municipalities in improving the implementation of this program through modifying the policy protocol for waste separation plans and providing

robust enforcement guarantees for the modified policies. For a feasible policy, it is recommended to establish an autonomous department with independent operator in the waste management organization to implement the recycling programs.

Similar to our findings, Henry et al. (2006) and Regassa et al. (2011) reported the poor performance of private sector as a major problem in implementing the HSWSP. Some researchers reported major reasons for poor performance of contractors including inappropriate use of transportation equipment, poor planning, poor enforcement of municipal regulations and lack of proper contracts (Kirama and Mayo 2016). In addition, Asnani and Zurbrugg (2008) in India associated the poor performance of the private sectors to the longevity of contracts established with them. Such long-term contracts may lead to the contractor's exclusivity and, consequently, to the loss of municipal control on the implementation of the program. In contrast, Kirama and Mayo (2016) reported that short-term contracts with private sectors may limit their ability to adopt strategies and develop technological innovations, which may weaken their performance in program implementation. These controversial findings may indicate that the policies and activities adopted in a region may not necessarily be successful in another region. Therefore, the policies and measures should be adopted in a way that would be appropriate to the situation of a specific region. However, the contractor's performance may also be influenced by the decisions of the municipal authorities. This means that municipal authorities can affect the performance of the contractors through monitoring their performance, arranging appropriate contracts and logistical supporting of the contractors. It is therefore suggested to the responsible organizations to promote the monitoring system of the private sectors' performance and to encourage the private sectors for better performance through providing them with financial supports, equipment and subsidies and reducing their taxes.

An important issue in the present study, which may be associated with poor implementation of HSWSP at source, was the lack of integrity in the urban management system of the municipality. As we identified in the present study, the level of success in implementing HSWSP at source was variant at different regions of the city, which may be due to the lack of a regular integrated management system for the single planning program. Integrated management of HSWSP at source may optimize the management of urban solid waste in all sectors and may promote the participation of stakeholders, the effectiveness of the services and the processes of waste separation and recycling (Memon 2010). The lack of integrated urban management system has been reported as a major challenge in the metropolitan cities of Iran (Sarafi 2009; Pourahmad et al. 2012) and some other developing countries (Zotos et al. 2009), as well. These results indicated that municipal authorities can take an important step in successful implementation of the programs through integrating HSWSP at source to the national waste management programs.

## 5 Recommendations

According to the findings of the current study and the local conditions, the following actions are suggested to improve the implementation of HSWSP at source:

- Designing and implementing coherent and continuous educational campaigns to inform the citizens about the benefits of waste separation and to increase their participation rate in source separation of waste. In order to better inform the citizens on their role in implementing HSWSP at source, more diverse channels like mass media (local radio/

T.V/newspaper), clergymen in religious customs and seminars, health volunteers and social virtual networks should be incorporated.

- Applying non-governmental organizations to promote public participation and awareness rising on the benefits of source separation of waste.
- Applying ongoing intermittent advertisements about the progress of implementing the plan throughout the city by establishing banners in crowded places such as shopping malls, parks, sport clubs, schools, mosques. Such advertisements may result in sharing information on the progress of the plan with the citizens and may promote their motivation to comply with source separation of waste.
- Jointing and organizing the unauthorized collectors in the program as the forces who are supported by the waste management organization.
- Fining the individuals who collect solid waste, illegally.
- Organizing a supervisory team from the legal professionals of MWMO to supervise the implementation of the project.
- Providing the contractors with subsidy funds and infrastructural facilities by the MWMO in order to improve their performance.
- Installing sufficient numbers of appropriate garbage cans, specifically designed for separation of wastes, throughout the city.
- Establishing contracts with the private sectors that have the best experience in performing source separation of waste programs.
- Inviting economists, urban planners and educational planners to cooperate with the MWMO while programming, updating and implementing the HSWSP at source.
- Allocating an appropriate amount of budget to the implementation of plan.
- Monitoring and evaluating the private sector's activities by the officials of MWMO.
- Setting fines for poor performance (e.g., lack of on-time collection of separated waste) of the contractors and their collectors.
- Establishing inter-sectoral and intra-sectoral collaborations with associated organizations such as education, police force and health to support the implementation of the program.

## 6 Conclusions

According to our results, many social and organizational challenges may threaten the source separation of waste programs, which may be due to the lacks in policymaking, legislation and improper planning of the authorities. Some of the identified challenges like the lack of participation among citizens and their neglect of separating the wastes may confirm our claim that the waste management organization has not yet been successful in educating public on the plan and institutionalizing the program before and during its implementation. Other identified challenges such as garbage robbery and poor performance of the private sector may indicate the lack of considerations on the outcomes of HSWSP at source during program designation and also the lack of strong legal mechanisms to implement the program. Key authorities and waste management policymakers should design or revise HSWSP at source programs with an appropriate focus on policy development and a clear consideration on the potential outcomes of the program. Paying attention to evidence, like those presented in our study, while planning such programs may improve the outcome of the plans.

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## Compliance with ethical standards

**Conflict of interest** The authors declare that they have no conflict of interest.

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