

Towards improved governance for sustainable solid waste management in Lebanon: Centralised vs decentralised approaches

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Abstract

Solid waste management is a multifaceted task that incorporates a diverse set of shareholders and operations. To create a sustainable solid waste management system, governments should select the most advantageous organisational structure, given a country's current setting; contextualising the sector's administrative structure in accordance with a nation's organisational constraints. This research aimed to determine the recommended level of administrative and financial decentralisation for each solid waste management operation and explore the susceptibilities and prospects of each level of governance in Lebanon. Primary data was gathered from environmental experts and concerned organisations using a semi-structured in-depth interview. Results revealed that the optimal model for solid waste management in the case of Lebanon incurs devolving collection, which would assimilate local populations into the decision-making process and reduce opposition towards devised solid waste management plans. Delegation and the construction of centralised treatment facilities is recommended as it incentivises municipal cooperation and permits the installation of methodologies and technologies that reflect the limitations, public attitudes, and waste dynamics of each distinct geographical territory. Deconcentrating disposal would limit the number of landfills constructed and facilitate monitoring. Administrative and constitutional reformations that clearly define the roles and responsibilities of public agencies would reduce the influence of the central authority on peripheral states. The establishment of municipal cooperation models would diminish regional economic disparities by enhancing the level of communication and collaboration between subnational bodies. The performance of decentralised strategies should be continuously monitored to ensure that local administrators are held accountable.

Keywords

Decentralisation, centralisation, solid waste, management, challenges, prospects

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Introduction

The management of solid waste is a complex set of services, traditionally entrusted to local authorities for delivery, encompassing various stakeholders from both public and private sectors. The primary purpose for a solid waste management (SWM) system involves negating the adverse impacts created by solid wastes on public health and the environment. Public demand for sustainable SWM, most eminently in developing countries, have elevated the financial and technological burden placed on seemingly fragile solid waste systems. Several nations opted to shift from the traditional centralised waste management scheme, adopting a decentralised form instead, in a bid to relieve the incremented pressure. The decentralisation of a system involves the transfer of responsibilities and authority towards lower organisational levels, as opposed to a centralised system whereby decision-making authority rests in the hands of high organisational levels, such as the government (Thompson, 2016). According to Faguet, decentralisation is the:

devolution by central (i.e., national) government of specific functions, with all of the administrative, political, and economic attributes that these entail, to regional and local (i.e., state/provincial and municipal) governments that are independent of the centre within given geographic and functional domains (Faguet, 2014).

Nevertheless, comparisons between centralised and decentralised SWM systems are drawn out on the basis of three distinct

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dimensions (Körner et al., 2008; Okot-Okumu and Nyenje, 2011; Sharma and Bardhan, 2012).

- Decision-making authority: Authoritative power within a centralised system is consolidated by a few select individuals; whereas in decentralised systems decision-making authority is dispersed among various governing bodies.
- Geographical location of SWM facilities: Centralised organisational hierarchies are characterised by the concentration of a limited number of large-scale SWM facilities within select territories. Meanwhile, in decentralised hierarchies, a large number of small-scale SWM facilities are constructed and spatially distributed across the entire nation.
- Liability and responsibility: In centralised systems the government retains its position as the highest organisational entity and is held accountable for any fallacies in service delivery. Meanwhile, in decentralised layouts, the national government forgoes its authority over the sector to subnational governments.

The beneficence of a decentralised SWM system stems from the empowerment of local communities; incurring in the establishment of context-specific developmental programs based on the necessities and conditions of local populations. However, the dissolution of a system cannot be realised through a single activity, as decentralisation frameworks call for the revision of legislative, financial, and political structures. This article identifies three principle aspects for decentralisation: political, fiscal, and administrative. Decentralisation is inherently a political issue as it deals with the redistribution of power among different administrative levels. The central government must legally recognise the territorial boundaries over which local governments may exercise their authority; to avoid infringement of autonomy among the various districts or between the national and local officials (Lessmann and Markwardt, 2016; Mulvaney, 2010).

Fiscal decentralisation alludes to the reorganisation of inter-governmental financial systems, whereby peripheral authorities are granted broader monetary power. Financial autonomy is a fundamental element in decentralisation. Without adequate fiscal sovereignty, decentralisation strategies are subverted as local governments would continue to be influenced and be reliant on the central authority. However, the majority of subnational units cannot obtain self-sufficiency; continuing to partially rely on the national state. The national authority ought to continuously dispense fiscal support towards local governments through inter-governmental and loan transfers (Dexu and Wenlong, 2017; Goel et al., 2017; Lessmann and Markwardt, 2016; Mulvaney, 2010; Sow and Razafimahefa, 2015).

Administrative decentralisation is categorised into three divisions, namely deconcentration, delegation, and devolution. Deconcentration, involves the expansion of state authority over a greater geographical area, undertaken by the transfer of legal, financial, and administrative responsibilities to lower levels of the central government; whereby state officials are relocated and

regionally diffused to peripheral offices. Deconcentration is widely considered the weakest form of decentralisation, as sub-national governments do not formally participate in the decision-making process; preserving the position of the central government as the constitutional administrator. Delegation is also perceived as a formal agreement between two parties over a task or responsibility; whereby an authoritative body (such as the national government) grants executive power to an agency for conveying a specified function maintaining a top-down approach to governance, since the local administration continues to be liable to the central authority. Devolution represents the most extensive form of administrative decentralisation; whereby the complete responsibility and decision-making authority for specified functions is relocated from the central government towards autonomous subnational bodies (Mulvaney, 2010; Regmi et al., 2010).

Contemporary forms of centralised and decentralised administrative constitutions exist for each of the primary SWM operations – collection, treatment, and disposal. However, in light of the aforementioned social, political, and financial imperatives, no reasonable illustrations exist in the literature (Guerrero et al., 2013; Ma and Hipel, 2016; Marshall and Farahbakhsh, 2013; Meidiana and Gamse, 2010; Mmereki et al., 2016; Okot-Okumu and Nyenje, 2011) regarding completely centralised or decentralised SWM schemes; with most SWM systems synchronising centralised and decentralised elements forming ‘hybridised’ organisational models.

Municipal SWM in Lebanon has developed into a perpetual chronic ailment affecting the entire nation. Lebanon’s SWM construct suffers from conditions exhibited in other developing countries, which include but are not limited to infrastructural and financial deficits and political intrusion (Manaf et al., 2009). The lack of a contingency plan and the consistent reliance on ad hoc strategies for handling the solid waste sector culminated into a nationwide garbage crisis when the country’s largest landfill was brought to a close. The crisis commenced on July 2015, and has spun up until today, with the event bringing SWM to the headlines and validating the need for a national sustainable strategy that shifts SWM from the emergency framework enforced by the government, for the past 20 years, towards a sustainable solid waste system (Basim, 2016; Sweep Net, 2014). Lebanese decision-makers sought to amend SWM, through the development of a decentralised SWM action plan; whereby solid waste operations were conveyed to local authorities (municipalities) in a bid to culminate the ongoing crisis. However, the proposed Lebanese SWM strategy failed to accommodate for the financial, economic, technical, social, and political deficiencies afflicting local governments, which, if unaddressed, may lead to further deterioration of the solid waste sector. The scheme thus far fails to denote the degree of decentralisation that the solid waste sector in Lebanon will undergo, and fails in addressing the problem on a national basis. Therefore, the primary goal of this research is to assess the challenges, enabling factors, and prospects of a decentralised structure of governance, by examining the findings derived from the case of Lebanon. The outcomes of this research

Table 1. Subnational governments in Lebanon (Lebanese Center for Policy Studies [LCPS], 2015).

Subnational unit	Number
Counties (Mohafaza)	8
Districts (Cazas)	31
Municipal Unions	51
Municipalities	1431

are directed towards enabling decision-makers to overcome the obstacles and impediments hampering the implementation of a sustainable SWM framework in both Lebanon and other developing nations.

Research methodology

Study design

The territorial administrations capable of operating a SWM system are selected on the basis of populace. The administrative decentralisation of SWM was studied at three distinct governmental tiers: County (Mohafaza), district (Caza), and municipal unions or large municipalities (Table 1). The Lebanese government does not characterise what constitutes a large municipality. Accordingly, in this study, municipalities with a populace greater than 24,000 were classified as large. County would represent decentralisation in the form of deconcentration, which is kindred to the current system implemented in Lebanon whereby a governmental official, governor, oversees developmental operations in counties. District embody delegation, as district committees, function as semi-autonomous entities liable to the government. Municipalities or municipal unions exemplify devolution, working as a self-governing sub-national body accepting full accountability for designated waste operation(s).

Data collection

A semi-structured in-depth interview was chosen as the method for qualitative data collection. It is a focused discussion that is guided by a set of predetermined questions that are, typically, open ended and clearly defined. The objective of the interview would be directed towards attaining greater insight regarding a certain theme, through an in-depth exploration of the participant's opinions, perceptions, and expertise. The transcribed responses would serve as the basis for extrapolating a set of interpretations, conclusions, and recommendations regarding a topic of interest. Furthermore, despite the interviewees being subject to a fixed set of questions, semi-structured interviewees are characterised as being dynamic, allowing the interviewer to adapt to the flow of the conversation (Kallio et al., 2016; Turner, 2010). An interview guide had been formulated to cover the following issues: the best possible governance level for the different SWM operations, the strengths and weaknesses of each option, other potential non-environmental advantages and enabling factors. This interview guide helped predetermine the scope of the interview, all while

permitting the interviewer to adapt to the conditions of the participant. Flexibility in the wording and order of the questions allowed for the rearrangement, addition, or elimination of follow-up questions when probing the interviewee, all while ensuring that key points or questions are not omitted in the process (Galletta, 2013; Nguyen, 2015). Table 2 summarises the in-depth questions of the interview guide related to the study's objectives. Interviews were conducted in either Arabic or English, depending on the preference of the interviewee. Data had been collected via hand written notes. The information that the stakeholders provided was treated confidentially and names were not displayed in the report. Before carrying out the interview, consent was taken from the interviewee. Individual responses have not been linked to individual respondents.

Recruitment of participants

Interviewed stakeholders were selected on the basis of their capability of influencing the success of an administrative reform in the solid waste sector. Probed participants included environmental experts and concerned governmental and non-governmental organisations. Table 3 summarises the list of the stakeholders interviewed.

Data analysis

Thematic analysis was employed to thoroughly examine and evaluate the transcripts comprehensively, following the set objectives of the research. The interviews were categorised and coded into topics/themes where transcripts had been sorted out according to the study questions. This procedure ensured that spread parts of information on the same topic are consolidated for a complete review. Also, trends and patterns that reappeared among different interviews were identified. Data analysis had been conducted by hand, using grids and matrices to summarise themes and organise findings. Furthermore, direct quotes from participants were used to support common themes. The gathered data was then summarised and organised in SWOT (strengths, weaknesses, opportunities, threats) thematic analysis matrices that address the diverse governance levels of the various SWM operations. The developed SWOT thematic matrices were further analysed, with the aim of identifying the compatible level of decentralisation for each solid waste operation.

Results and discussion

Legislative and administrative framework for SWM in Lebanon

A coherent national legislative framework concerning SWM has yet to be established in Lebanon; with policies and laws tackling the solid waste sector being characterised as incomplete or outdated. The existing legislations lack application decrees, have limited provisions for technical standards and specifications for service, do not incorporate advanced knowledge regarding latest

Table 2. Summary of the Interview questions linked to the study objectives.

Objectives	Questions
Determine the recommended level of administrative and financial decentralisation for each solid waste management operation.	1. Which of the three governing bodies (county, district, and/or municipal unions/large municipalities) do you think should be responsible for solid waste (a) collection, (b) treatment, and (c) disposal and why? 2. What obstacles hinder the other governing bodies (which you have not chosen) from carrying out the aforementioned activities? 3. Through what means will governing bodies procure the compulsory funding to carry out designated solid waste operation(s)?
Explore the opportunities and strengths for each level of governance.	4. What are the environmentally beneficial factors of the selected governance levels for solid waste operations? 5. What are the non-environmental advantages of the selected governance levels for solid waste operations? (For example, financial redistribution, higher efficiency managerial development, job creation, etc.) 6. Legislation concerning solid waste management in Lebanon is outdated and incomplete. What alterations in the government's solid waste management policy, could the preferred authoritative bodies invoke? 7. What is the relationship between the selected governance level and the informal structures created by society, such as community-based institutions, associations, and organisations?
Identify the impotencies and threats presented at each of the governance schemes.	8. What is your position regarding the utilisation of public-private partnerships in the provision of solid waste services? 9. What are additional risks associated with the governance level that you have selected? 10. What issues should each of the selected governance bodies seek to improve and what should they avoid?

Table 3. List of stakeholders interviewed.

Position [number of persons interviewed]
Heads of municipal unions/Heads of large municipalities (or their representatives) [4]
Governor (or a representative) [1]
Representative from OMSAR (Office of the Minister of State for Administrative Reform) [1]
Representative from the Ministry of Environment (MoE) [1]
Representative from the Ministry of Interior and Municipalities (MoIM) [1]
Representative from CDR (Council for Development and Reconstruction) [1]
Representative from the UNDP (United Nations Development Programme) [1]
Non-governmental organisations (NGOs) [2]
Independent Municipal Fund (IMF) [1]

technologies, and do not consider financing and cost recovery of waste management (MOE/UNDP/ECODIT, 2011). Generally, in Lebanese urban centres, SWM is administered in a manner similar to industrialised nations; whereby centralised treatment and disposal facilities are constructed, and private and non-governmental agencies are incorporated into the organisational scheme. However, the constitutional hierarchy, most notably in rural areas, parallels SWM frameworks typically enacted in developing nations. Consequently, the drawbacks of the Lebanese SWM scheme coincide with the pitfalls displayed in decentralised solid waste organisational structures implemented in Third World countries, which include the following (Guerrero et al., 2013; Marshall and Farahbakhsh, 2013; MOE/UNDP/ECODIT, 2011).

- The maintenance of a top-down approach to management as a result of the centralisation of sources of fiscal revenue, the lack of public participation, and the overlap in judicial authority between national and subnational agencies.

- Deficiencies in legislation tackling SWM.
- Lack of horizontal cooperation between stakeholders.
- Disconnect between national and subnational bodies.
- Unwillingness of governmental administrators to handle the sector.

The feedback provided by stakeholders was manifested with redundancy, as numerous themes were reiterated by all respondents, regardless of the authority nominated to assume the responsibility. The majority of governmental authorities conceived that the administrative entity they adhere to possesses the adequate capacity to capitalise on an explicit strength or opportunity in the most comprehensive manner, meanwhile diminishing conceivable weaknesses and risks. Responsibility for the poor performance of the government, in terms of service provision, was redirected onto externalities; most notably politics, public incompliance, deficient financial capital, and the lack of coordination between stakeholders. These limitations are commonly

observed in decentralised frameworks adopted in developing nations (Ahmed and Ali, 2004; Mmereki et al., 2016).

The recommendations communicated by interviewees mirrored several of the suggestions and opinions put forth by international environmental experts for the advancement of solid waste frameworks; most notably the need to include private enterprises into the waste hierarchy, through the formation of public–private-partnerships (Guerrero et al., 2013; Shekdar, 2009). Institutional representatives reported that the private sector augments service delivery by enhancing the efficiency and capacity of local governments. This result is compatible with other studies stating that public–private-partnerships amplify the financial, technical, and managerial capabilities of public agencies (Ahmed and Ali, 2004; Chaerul et al., 2007; Ibrahim and Mohamed, 2016; Zhang et al., 2010). Several participants emphasised on the need to monitor the performance of private firms and examine the manner in which contracts are awarded; highlighting the need for accountability. They claimed that the absence of proper supervision would continue to undermine the potential of public–private-partnerships and would lead to a replication of the current situation.

The principal variations in the responses of interviewees were constricted to the number of stakeholders a framework should encompass, and the governmental entities that ought to supervise a newly contrived program. Municipal unions, who were primarily elected by local officials, would represent a devolved framework that would encompass the smallest amount of stakeholders and would utilise the least technologically intensive facilities. Meanwhile, counties, who were primarily elected by state officials, would represent a centralised framework that would accommodate the greatest number of shareholders and would utilise the most technologically intensive methodologies.

Recommended level of administrative and financial decentralisation

Collection. Several officials asserted that the accessibility of local administrators to sources of waste generation, along with their familiarity with the landscape of regional cities, present them as the most qualified entity for administering the operation. Municipal authorities hold a select advantage over other governmental organisations by being in ‘face-to-face’ contact with residents and industries; facilitating the processes of tax collection, and the reinforcement of public apprehension regarding environmentally sound practices. Thereby, legitimising the feasibility of executing a door-to-door collection scheme, which promotes community participation and amplifies the process of waste treatment by reducing cross-contamination among refuse.

Furthermore, local officials conceived that the current public–private format for the collection of solid wastes represented an ‘unsustainable monetary risk’; proclaiming that the operation currently depletes roughly ‘50-70%’ of a municipality’s intergovernmental grants. However, several of these findings were inconsistent with those delineated by Akin et al. (2016), Hoornweg and

Bhada-Tata (2012), and Mmereki et al. (2016), who illustrate that local governments collect taxes at rates lower than central authorities do. Local governments typically exhibit higher levels of corruption and suffer from limitations in available capita and that public–private-partnerships assist in reducing the cost of waste collection, which can consume up to 90% of solid waste budgets. Moreover, municipalities typically suffer from impaired financial and managerial capacities that deter them from properly conveying the service. Studies reported that the establishment of a sustainable door-to-door collection scheme in developing countries is difficult and inapplicable if user fees are not implemented and private and non-governmental institutions are not integrated into the process (Henry et al., 2006; Sharholly et al., 2008). This finding was not reiterated by all participants, as various governmental authorities advocated for the exclusion of Non-governmental organisations (NGOs) and community-based organisations (CBOs) from all solid waste operations; including door-to-door collection schemes.

Yet, others (mainly ministerial representatives) articulated that an extensively decentralised door-to-door collection scheme would entail higher operational costs, owing to the elevated consumption of waste packaging material (plastic bags) and the increased number of vehicles utilised. In addition, several institutional representatives emphasised the difficulty of source segregating refuse in vertically grown cities, such as Beirut, where it was said to have been previously attempted. An argument sustained by Metin et al. (2003) and Srivastava et al. (2005) who reported that the high consumption of plastic bags elevates the operational costs of door-to-door collection schemes; especially in settings where population densities and waste generation rates are high. In agreement with other studies (Mmereki et al. 2016), few interviewed stakeholders concluded that the operational strategy endangers the livelihood of the existing network of scavengers, who rely on salvaging recyclables from wastes accumulated in communal bins, which may incite conflict. Additionally, government representatives considered centralised waste collection schemes that primarily rely on the accumulation of wastes in communal bins are unhindered by public compliance and require low implementation costs. Moreover, a centralised operational scheme would diminish public opposition since the need to implement user fees is negated, attributed to the high financial capacity of counties as compared with municipalities. A SWOT thematic analysis matrix (Table 4) summarises and organises the benefits and pitfalls associated with devolved and deconcentrated frameworks for solid waste collection.

Almost all interviewees expressed the need to implement distinct operational schemes between urban centres and rural areas; whereby communal bins are utilised in densely populated cities. This finding is inconsistent with the recommendations of studies (Anghinolfi et al., 2016; Beigl and Salhofer, 2004; Gallardo et al., 2012; Larsen et al., 2010; Mora et al., 2014) that emphasised the need to establish a decentralised door-to-door collection scheme in both urban and rural areas, despite the reported difficulties and elevated costs. The framework supplements the processes of

Table 4. SWOT analysis matrix for collection services.

Leadership ^a	Strengths	Weaknesses	Opportunities	Threats
Municipalities/ unions	<ul style="list-style-type: none"> • Close proximity to waste producers • Enable the implementation of a door-to-door collection scheme • Enhance the spreading of environmental awareness • Provide municipalities with financial support through added tariffs 	<ul style="list-style-type: none"> • Difficult to apply in urban centres • High cost in service delivery • High operational costs and increased use of packaging material • Poor collection of taxes and fees, due to the proliferation of corruption • Increase in greenhouse gas emissions, due to the increase in utilised vehicles 	<ul style="list-style-type: none"> • Utilisation of CBOs and NGOs • Promotes community participation • Reduced waste volume • Increased resource recovery • Reduce cross-contamination among wastes • Engagement of local populations 	<ul style="list-style-type: none"> • Communal antagonism towards supplementary taxation • Lack of community participation • Public incompliance • Endangers the livelihood of the private informal sector • Conflict among stakeholders
Counties	<ul style="list-style-type: none"> • Reduce conflict among stakeholders • Unconstrained by public compliance • Preserve the role of the private informal sector • Negate the need for additional taxes. • High financial capacity 	<ul style="list-style-type: none"> • Commingled wastes • High waste volume, due to the lack of waste segregation • Difficulty in communicating with residents 	<ul style="list-style-type: none"> • Low operational costs • Higher tax revenue, since central authorities collect taxes at rates higher than local authorities • Relatively easy to implement in urban centres 	<ul style="list-style-type: none"> • Reduced resource recovery as a result of the continued operation of the informal sector • Low quality recyclables, due to cross-contamination • The informal sector reclaiming a large proportion of recyclables • The exclusion of NGOs and CBOs from the operation

^aDistricts were not elected by any of the representatives to assume the operation, hence the subnational government was excluded from this SWOT table.

CBOs: community-based organisations; NGOs: non-governmental organisations.

treatment and disposal by producing segregated waste streamlines, which decreases cross-contamination, increases resource recovery, and diminishes waste volume (Kinnaman, 2010; Wilson et al., 2012; Xue et al., 2015). Mmereki et al. (2016) reports that the costs of decentralised schemes can be reduced if local communities engage in monitoring and assessing the performance of municipalities, which would lead to higher efficiency in tax collection and service delivery.

Treatment. Advocates of devolution, most prominently local officials, solicited the abolishment of the concurrent ‘*Top-down*’ approach to management, by means of detaching the revenue-generating operation from the central authority; enhancing the fiscal autonomy of local administrations. Local officials sought to divert the operation away from counties, conceiving that public opposition directed against the national government would lead to the discontinuity or failure of centralised developmental project units. This was exemplified by one of the respondents who stated that local inhabitants recently vandalised a sorting/composting facility constructed by national agencies. Local officials attributed the negative sentiments fostered by the populace towards central authorities to the increasingly stratified organisation scheme of SWM, which hinders communication and disconnects affiliated stakeholders. Peripheral authorities were perceived to be capable of enhancing the receptiveness of

stakeholders towards the construction of localised treatment units by supplementing public awareness and inciting cooperation among regional stakeholders. Moreover, local officials contended that localised treatment units would diminish the cost of waste transportation and reduce greenhouse gas emissions since wastes would be treated in close proximity to their points of generation. Although certain studies confirm the prior claims (Ellyin and Themelis, 2011; Sharholy et al., 2008), other studies report that treatment plants located near residential areas jeopardise the health of local inhabitants (Domingo and Nadal, 2009).

State administrators cited that municipalities utilise available financial and human capital in an uneconomical manner and that municipal employees possess limited monetary competence. This finding is confirmed by authors who attributed the inefficiency of municipalities to the absence of state monitoring, which allows the proliferation of corruption (Lessmann and Markwardt, 2010; Massoud and El Fadel, 2002). Furthermore, state administrators asserted that decentralised small-scale facilities are unsustainable, as a result of previously failed attempts which demonstrated that the financial and infrastructural deficiencies afflicting rural local governments deter the devolvement of solid waste treatment. This argument is supported by the literature (Guerrero et al., 2013; Mmereki et al., 2016; Zurbrugg et al., 2004), since small-scale facilities have generally been proven to be financially unsustainable in developing countries; because the

price of compost typically exceeds that of fertilisers, which limits its marketability. Moreover, the cost of operating and preserving treatment plants has proven to be very burdensome for municipalities with limited financial capital, and open dumping remaining a much cheaper option than treatment, which reduces the willingness of municipal officials to undertake the operation (Mmereki et al., 2016; Talyan et al., 2008; Zhang et al., 2010).

Consequently, districts emerged as a potential governmental body for supervising the operation. Several respondents, most notably local officials, articulated the prospect of aggregating the financial and managerial proficiency of all municipalities and unions within a prescribed territory, in a bid to reduce the vulnerability of local governments. Participants contemplated that the population and geographical size of districts permits the adoption of a wide array of technologies with varying capacities, diversifying the end products of the operation; unlike singular municipalities and unions who are primarily limited to organic forms of treatment. However, unlike municipalities/unions or counties, no authoritative body is designated to govern districts. The vast majority of respondents stressed that the political impotence and the legislative limitations of subnational units deter the inception of a contemporary government; expressing the need to augment municipal cooperation, rather than rely on the formulation of a new administrative level. This model of governance is employed in developed nations, where municipalities integrate their financial and managerial capacities, in order to establish centralised treatment facilities that serve a specified geographical territory (Zaman, 2010).

State administrators, on the other hand, expressed reduced confidence in the performance and efficacy of local governments, accredited to the prohibitive technical, managerial, and administrative deficiencies plaguing peripheral institutions. They advocated the installation of centralised treatment facilities, identifying counties as the most competent subnational division for superintending the operation based on the following.

- The large population enclosed within the subdivision, which entails a continuous unobstructed supply of a wide variety of wastes.
- Counties possess the adequate financial capacity required to install large-scale centralised treatment units.
- Counties have large swaths of available territory.
- A substantial number of stakeholders are correlated to the agency, which assists in synchronising developmental efforts undertaken by miscellaneous organisational institutions.
- Centralised treatment units are cost effective, easy to monitor, and are located in regions distant from local populations.

These results are in agreement with other studies (Anwar et al., 2018; Chan et al., 2011; Perkoulidis et al., 2010; Wang et al., 2008) that supported the construction of centralised treatment facilities because generated revenue could be dispersed over a larger amount of stakeholders, which would decrease regional economic disparities. However, authors contemplated that municipal governments ought to be included into the decision-making process, since local officials would ensure that the

employed technologies and methodologies reflect the limitations, public attitudes, and waste dynamics of each distinct geographical territory (Mmereki et al., 2016; Shekdar, 2009; Talyan et al., 2008; Zhang et al., 2010). The advantages and drawbacks of each level of governance are categorised in Table 5.

Disposal. Local officials observed that problems associated with solid waste disposal stem from the constitutional violations undertaken by governmental regulatory agencies and the economic disparities between urban and rural areas. As in the case of solid waste treatment, municipal authorities and NGOs maintained that peripheral governments are capable of overcoming their contemporary technical, operational, and financial deficiencies by coordinating the efforts of clusters of local governments. This finding is confirmed by the Ministry of Environment, which reports that in Lebanon, the only areas not employing open dumping as a method for disposal were regions where a cluster of municipalities aggregated to form centralised landfills (Sweep Net, 2014). Promoters of devolution apprehended that localised disposal units constructed at the municipal level can be implemented if the national government provides local authorities with the adequate financial support. Nevertheless, the environmental advantages of installing decentralised disposal sites were not profoundly pronounced by participants, with the derived benefits being limited to reductions in implementation costs, travel distances, and waste volume (USEPA, 2014). A state administrator reported:

Local authorities are incapable of differentiating between sanitary landfilling and open dumping, which has resulted in a drastic increase in open dumpsites in recent years.

State administrators stipulated that the lack of experience, environmental literacy, financial capital, and available territory hinder the establishment of sanitary landfills at the municipal level. Contending that the installation of centralised disposal facilities on the scale of counties would limit the number of landfills constructed, which facilitates monitoring, diminishes the amount of territory consumed, and incentivises the implementation of previously drafted SWM master plans that target the territorial district. Studies substantiated by the US Environmental Protection Agency (USEPA) report, that the decrease in land availability coupled with the increase in public opposition towards local disposal sites, have caused the establishment of decentralised waste disposal facilities to be increasingly difficult. Developed nations are seeking to diminish the negative environmental health outcomes associated with waste disposal by decreasing the amount of landfills constructed. Diverting from small-scale municipal landfills towards centralised regional landfills that are situated farther away from residential households, can engulf large quantities of diverse wastes, and are capable of generating revenue through energy recovery (USEPA, 2014, 2016).

Most institutional representatives concluded that centralised landfills are likely to be allocated in regions with low socio-political stature. Counties were noted to be the most vulnerable government to political intrusion attributed to the constitutional significance of each district; an argument reinforced by Ahmad

Table 5. SWOT analysis matrix for solid waste treatment.

Leadership	Strengths	Weaknesses	Opportunities	Threats
Municipalities/ unions	<ul style="list-style-type: none"> • Close proximity to sources of waste generation • Supplements local economies • Improve public awareness • Incite cooperation between local stakeholders 	<ul style="list-style-type: none"> • Limited technological capabilities • High operational costs • Inefficient utilisation of capita • Limited marketability of compost • Situated near residents • Limited availability of territories • Relatively difficult to monitor 	<ul style="list-style-type: none"> • Augment cooperation between municipal unions • Decrease in public antagonism • Employment of the most appropriate treatment methodologies 	<ul style="list-style-type: none"> • Increase in regional economic disparities • Infrastructural and operational limitations • Proliferation of corruption • Limited to organic byproducts • Cost-ineffective • Unwillingness of local officials to perform the operation • Increase in rates of disposal
Districts	<ul style="list-style-type: none"> • Enhanced municipal cooperation • Synchronise developmental efforts • Diverse byproducts • Employment of the most appropriate technologies and methodologies • Easy to monitor • Cost-effectiveness (economy of scale) • Improve public awareness • Financially resilient 	<ul style="list-style-type: none"> • Absence of sufficient regulatory legislation • High investment cost • Inefficient utilisation of capita 	<ul style="list-style-type: none"> • Augment cooperation between municipal unions • Decrease in regional economic disparities 	<ul style="list-style-type: none"> • Proliferation of corruption • Political impotence
Counties	<ul style="list-style-type: none"> • Distant from residents • Synchronise developmental efforts • Relatively high financial capabilities • Diverse byproducts • Availability of large territories • Easy to monitor • The supply of refuse is uninterrupted • Cost-effectiveness (economy of scale) • High financial capacity 	<ul style="list-style-type: none"> • Maintenance of a top-down approach to governance • Long transportation distance • High investment cost 	<ul style="list-style-type: none"> • Decrease in regional economic disparities 	<ul style="list-style-type: none"> • Substantial investment costs • Limited communication between central and peripheral stakeholders • Negative public attitudes • Exclusion of local officials from the decision-making process

et al. (2015) who stipulate that the social, political, and economic dimensions of a region influence where landfills are allocated. Furthermore, according to Norton et al. (2007), ethnicity and income are factors that influence that allocation of solid waste facilities. State administrators articulated that the implementation of environmental impact assessments would ensure that disposal sites are elected in a scientific and unbiased manner that would help in reducing the adverse effects of landfilling. Table 6 summarises the differences associated with implementing the distinct frameworks proposed by participants.

The majority of local officials encouraged the formation of a devolved SWM structure primarily for the collection services; whereby the authority of administering the sector is unreservedly in the hands of municipalities and unions. Local officials support devolving SWM as it would diminish public opposition and would generate a more transparent administrative hierarchy since governance would be brought closer to the people. This argument is

supported by Ikhlayel (2018) who states that the juxtaposition of municipalities to residents allows local administrations to comprehend the fundamental needs of local populations. Municipal officials and NGOs contended that the installation of a centralised operational scheme would generate an organisational structure similar to the one currently implemented, where administrative bodies seem distant and inaccessible. However, local officials stated that devolvement does not entail the complete absence of the central government, according to a municipal representative:

The national government ought to be ever-present as intergovernmental transfers represent the only dependable source of income for municipalities, since the costs of implementing solid waste management projects remain unclear, and generated recyclables may not have a market in Lebanon.

This is in agreement with other studies reporting that the majority of subnational units, most notably rural, cannot obtain

Table 6. SWOT analysis matrix for solid waste disposal.

Leadership	Strengths	Weaknesses	Opportunities	Threats
Municipalities/ unions	<ul style="list-style-type: none"> Reduction in waste volume Reduced travel distances Low implementation cost 	<ul style="list-style-type: none"> Constricted financial capita Municipal officials suffer from limited environmental awareness Infrastructural and operational limitations Close proximity to residents Limited available territories 	<ul style="list-style-type: none"> Provision of financial incentives 	<ul style="list-style-type: none"> The large amounts of facilities constructed would make monitoring difficult Incompliance to environmental regulation (open-dumping or unsanitary landfilling) Absence of incentives Deterioration in environmental health Public opposition
Districts	<ul style="list-style-type: none"> Enhances collaboration between municipalities Proficient monitoring Reduced environmental contamination Financially resilient 	<ul style="list-style-type: none"> Absence of sufficient regulatory legislation, since the 2014 draft law has yet to be implemented High investment and operational costs High disposal rates Limited environmental awareness 	<ul style="list-style-type: none"> Energy recovery Distant from residential households 	<ul style="list-style-type: none"> Public opposition Long transportation distances High implementation costs Elevated socio-economic disparities Increased disposal rates
Counties	<ul style="list-style-type: none"> Reduced environmental contamination Reduced cost of planning High financial capacity Distant from residential households Reduces the amount of territory consumed 	<ul style="list-style-type: none"> Political and sectarian bias Long transportation distances High disposal rates High investment and operational costs 	<ul style="list-style-type: none"> Implementation of previously drafted plans Energy recovery High operational efficiency 	<ul style="list-style-type: none"> Increased disposal rates Political and sectarian intrusion High implementation costs Public opposition Elevated socio-economic disparities

self-sufficiency and continue to extensively rely on the national state (Davas et al., 2008; Kim, 2008). However, Feruglio and Anderson (2008) expressed that without adequate fiscal sovereignty, local governments would continue to be influenced and reliant on the central authority, which subverts the benefits of decentralising a framework. They contended that functions commonly performed by the central government, such as tax collection, ought to be diffused to regional authorities so that subnational governments are granted fiscal and political autonomy. Mmereki et al. (2016) reports that policies supporting local authorities are generally not implemented in developing nations, which cause municipalities to experience infrastructural deficiencies that prevent them from maintaining solid waste facilities. Furthermore, Mmereki et al. (2016) delineates that decentralised solid waste facilities that are constructed, operated, and maintained by municipalities suffer from relatively low production efficiency, and high operational costs. An argument confirmed by other authors who described decentralised treatment and disposal units as environmentally hazardous, inefficient, and unsustainable (Lohri et al., 2014; Wilson et al., 2012).

In spite of municipal and non-governmental representatives expressing great amenability and receptiveness towards the foundation of a new administrative government, districts were the least elected governmental entity among correspondents; with

only one local official advocating for the formulation of a new tier of governance. Respondents exhibited that the profound risk of political stagnation in the conception of a new governmental level deterred the election of the organisational institution; despite the subnational body presenting the foremost number of opportunities. Interviewees supported their stance by referring to the government's inability to issue new legislature or update outdated and ineffective civil penalties, maintaining that districts requisite unattainable constitutional amendments; citing the implausibility of implementing the '2014 decentralisation draft law' owing to the political construct of the nation.

Accordingly, several institutional representatives, most prominently local officials, advocated the establishment of municipal cooperation models across districts; rather than rely on the formulation of a new tier of governance. Participants articulated that coordinating the efforts of the large number of municipalities or unions that are situated within a district would permit local authorities to install a diverse set of centralised treatment and disposal units that can adopt a wide array of technologies with varying capacities. Hence, districts internalise characteristics associated with municipalities and counties, since the administration is devolved but the facilities are centralised.

A comparative study by Ahmed and Ali (2004) reports that developed nations, such as the United States and the EU, adopt a

framework similar to the one suggested above; whereby several municipalities collaborate in installing centralised solid waste facilities that serve local communities within a specified geographical territory.

Exponents of deconcentration were predominantly composed of officials within the national government, who proclaimed that the infrastructural deficit that exists between central and peripheral agencies impairs the implementation of a plausible solution to the solid waste dilemma in the foreseeable future; advocating the need to instil a predominantly centralised master plan for SWM. The hypothesised hierarchical structures postulated by state administrators were noted to progress into an increasingly centralised configuration as the framework advanced towards the final functional element, disposal. State officials denoted extensive distrust in the managerial capacity of peripheral authorities, signifying that the limited technical prospects of local directors, the large number of municipalities and unions across the nation, the financially exorbitant burden of managing the sector, and the need for a short-term solution; prohibited devolution. According to state administrators, a deconcentrated framework would be easier to monitor and implement, considering that a limited amount of facilities would be constructed and SWM frameworks that target counties already exist (the 2006 and 2010 master plans), which also reduces the cost of planning.

While several authors supported the construction of centralised solid waste facilities, which consume relatively small amounts of land, and are efficient, cost-effective, and easy to monitor, centralising decision-making authority was not advocated (Mmereki et al., 2016; Perkoulidis et al., 2010; Wang et al., 2008). Zhang et al. (2010) deduced that a sustainable SWM system requisites devolving the decision-making authority towards local authorities, to induce the establishment of developmental programmes based on the necessities and conditions of local populations. Furthermore, several authors confirm that the organisational, financial, and technical limitations of municipalities contribute to the failure of decentralisation efforts (Henry et al., 2006; Kim, 2008). Wit (2010) reports that decentralised frameworks fail primarily because state monitoring systems are not implemented, which results in the absence of accountability and the proliferation of corruption at the national and subnational levels. This finding was not reiterated by institutional representatives who identified monitoring programmes as tools used primarily to ensure that facilities are complying with standard environmental regulations.

Municipalities typically suffer from impaired financial and managerial capacities that deter them from properly conveying the service. The success of a decentralised system rests on the provision of local authorities with adequate sources of revenue. Subnational governments generally rely on two sources for income, primarily intergovernmental transfers and collected taxes and fees. If subnational governments are to independently administer SWM frameworks, they must be endowed with the power to ascertain adequate sources of funding. Functions commonly performed by the central government, such as tax collection, ought to be diffused to regional authorities. For example,

permitting local municipalities to tax their residents in exchange for the provision of solid waste services.

Conclusions and recommendations

In Lebanon, the continuous increase in waste generation and the absence of a comprehensive SWM strategy with clearly defined targets and objectives will cause the sector to continuously deteriorate. Despite the Lebanese government announcing its intentions to shift towards a decentralised model for SWM, by means of transferring the responsibility for solid waste operations towards local authorities, the means and preliminary measures that permit accomplishing this outcome have yet to be established. The optimal model for SWM incurs devolving collection, which would assimilate local populations into the decision-making process and reduce opposition towards devised SWM plans; delegating treatment, which incentivises municipal cooperation and permits the installation of methodologies and technologies that reflect the limitations, public attitudes, and waste dynamics of each distinct geographical territory; and deconcentrating disposal, which would limit the number of landfills constructed and facilitate monitoring. The sustainability of a decentralised framework is dependent on the level of fiscal and political autonomy that local authorities possess, the degree that subnational governments collaborate among each other and other public, private, and non-governmental stakeholders, and the extent at which policies and regulations are implemented.

The success of a decentralisation initiative in Lebanon remains contingent on resolving the underlying conditions that have prevented municipalities from handling the solid waste sector when the crisis ensued, conditions that continue to prevail until today. First, a legislative framework that defines the institutional groundwork for SWM in Lebanon remains unavailable. A coherent national legislative framework has to be established and enforced in addition to comprehensible monitoring and feedback mechanisms. Moreover, decentralised structures requisite rerouting revenue-generating operations from the central government towards subnational authorities, which would substantiate the fiscal and political sovereignty of regional administrations and reduce the involvement of the national government. Administrative and constitutional reformations that clearly define the roles and responsibilities of public agencies and transfer judicial authority from the national government towards subnational agencies would constrict the influence of the central authority on peripheral states. Updating and implementing environmental policies and regulations, such as financial incentives and disincentives would curb waste disposal rates and incentivise increasing waste treatment. The establishment of municipal cooperation models allow local administrations to share the responsibilities associated with operating solid waste frameworks, which reduces the vulnerability of local administrations and diminishes regional economic disparities. Integrating local populations, CBOs, and NGOs into the operational scheme would limit the fiscal strain situated on local authorities and would facilitate the implementation of financially burdensome frameworks, such as door-to-door collection schemes.

The efficiency of SWM frameworks can be improved through the establishment of training and awareness programmes that advance the technical and environmental competence of municipal workers. While the implementation of environmental impact assessments would assist in protecting politically and socially vulnerable populations by selecting disposal sites on the basis of sound scientific evidence. The performance of decentralised strategies should be continuously monitored by the national government and local citizens to ensure that local administrators are held accountable for any mismanagements.

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