Designing effective partnerships for waste-to-resource initiatives: Lessons learned from developing countries



Waste Management & Research 2015, Vol. 33(12) 1066–1075 © The Author(s) 2015 Reprints and permissions: sagepub.co.uk/journalsPermissions.nav DOI: 10.1177/0734242X15602964 wmr.sagepub.com

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Donovan Storey¹, Lorenzo Santucci¹, Rowan Fraser¹, Joao Aleluia¹ and Laksiri Chomchuen²

Abstract

Cities in developing countries across Asia-Pacific are struggling to effectively manage municipal solid waste (MSW). This is especially the case in secondary cities and small towns, which often face a lack of resources and know-how. Because the waste stream in these cities is usually high in organic content (50–80%) and recyclable materials (10–20%), waste-to-resource initiatives are viable options for sustainable MSW management. Waste-to-resource initiatives that are low-cost, low-tech, decentralised and community-based offer municipalities useful solutions for managing their MSW. However, the sustainability of such solutions depends on a number of key factors, such as the separation of waste at source, the effective engagement of communities and steady and predictable sources of revenue. Using quantitative data and qualitative information derived from field experience, this paper concludes that effective partnerships between a diverse range of stakeholders must be designed and fostered in order to achieve sustainability. The paper provides an analysis of stakeholder roles for the establishment of effective partnerships in four case study cities of Matale and Ratnapura (Sri Lanka) and Kon Tum and Quy Nhon (Viet Nam), where waste-to-resource facilities have been established, and explores the resources of stakeholders and how these can be mobilised to support waste-to-resource initiatives for revenue generation and long-term sustainability.

Keywords

Integrated solid waste management, waste-to-resource, reducing, reusing and recycling, developing countries, secondary cities, partnership, cost-recovery, sustainability

Introduction

Cities in the Asian and Pacific region are home to 2.1 billion people, over half of the world's urban population, and this number and share will continue to climb as the region urbanises through this century (United Nations Department of Economic and Social Affairs, 2014). By 2050, 65% of the region's population will be living in urban areas, up from 47.4% in 2014. Much of this growth will take place in cities of under 500,000 residents (i.e. secondary cities and towns) in middle- and low-income countries. Critically, these are also the cities that are typically least equipped to deal with the challenges brought about by rapid urbanisation.

Urbanisation will have major impacts on all areas of life, including the environment. One area of particular concern is municipal solid waste (MSW). As populations urbanise, income and consumer spending increase, resulting in proportionate rises in solid waste generation (Agamathu et al., 2009; Wilson et al., 2012; World Bank, 2012). Urbanisation and overall economic development also lead to changes in the composition of MSW. In low- and middle-income countries, organic waste dominates MSW. However, as countries grow richer, the percentage of paper and plastic waste increases considerably (World Bank, 2012). Within developing countries, rising MSW is often managed with little technical capacity and inadequate resources (Kawai and Osako, 2013; United Nations Human Settlements Programme, 2010). Open dumping and burning of MSW is commonly practised across the region, leading to a range of problems (Ball and Rodic-Wiersma, 2010).

New approaches, built on the principles of reducing, reusing and recycling (3R) solid waste, which are low-cost, low-technology, decentralised and community-based, offer municipalities viable solutions for solid waste management. In particular, the high percentage of organic waste in MSW streams in developing countries – averaging 50–80% of total solid waste – presents a

²Asian Institute of Technology, Thailand

Corresponding author:

¹United Nations Economic and Social Commission for Asia and the Pacific, Thailand

Donovan Storey, United Nations Economic and Social Commission for Asia and the Pacific, UN Building, Rajadamnern Nok Avenue, Bangkok, 10200, Thailand. Email: storey@un.org

considerable opportunity for turning waste into a resource (Asian Development Bank, 2011; World Bank, 2012). Already, across the region a range of 3R initiatives have been tested. Some have been successful while others have not. Research has shown that initiatives rely upon a range of enabling factors to facilitate performance, including technical, environmental, financial, socio-cultural, institutional and legal factors (Guerrero et al., 2013; Wilson, 2007).

A number of issues have been identified as contributing to poor operations of waste initiatives, including low community awareness, financing and cash flow management, low household participation, inadequate waste collection, limited engagement of the informal sector, limited human capacity and weak regulatory and enforcement systems (Asian Development Bank, 2011; Guerrero et al., 2013; Zurbrugg et al., 2012). Different roles and responsibilities can be identified in providing solid waste management services. For example, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH identifies six key roles: client, operator, revenue collector, regulator, policy and planning (GIZ, 2013). As such, sustainable solutions to these challenges must necessarily be sought from the interaction of a range of stakeholders (van de Klundert, 2000; Zurbrugg et al., 2012).

Partnership, both in its well-known form of private–public partnership, and more informal agreements between different actors, is a vehicle for achieving change on the ground and responding to these many issues (Forsyth, 2005; Sinha and Enayetullah, 2010). In particular, the informal sector is well recognised as a key partner in any sustainable waste-to-resource initiatives in developing countries (GIZ, 2011; Taiwo, 2011; Wilson et al., 2012). The informal sector has been recognised throughout the literature as an integral part of waste management systems and networks in developing countries, and any effective intervention must account for its role (Ahmed and Ali, 2004; Bruce and Storey, 2010).

In response to this, the objective of this paper is to examine the impact of partnerships on the sustainability of waste-toresource projects in developing countries. Specifically, this paper frames the role and activity of different types of partners in regards to waste-to-resource initiatives. This is based on an analysis of the various tangible and non-tangible resources that types of partners typically have access to, and how these resources can be leveraged for the overall sustainability of a project.

Materials and methods

This paper draws on primary data and experiences gathered over the course of six years, from 2009 to 2015, under the mantle of a programme led by the United Nations Economic and Social Commission for Asia and the Pacific (UN ESCAP) with technical support from Waste Concern, a non-governmental organisation (NGO) based in Bangladesh. The programme has established waste-to-resource initiatives in secondary cities and towns in Asia-Pacific using model waste-to-resource facilities developed by Waste Concern. In particular, the paper utilises data and information from the following four cities: Matale and Ratnapura (Sri Lanka) and Quy Nhon and Kon Tum (Viet Nam).

Several types of data and information collection methods have been utilised. Firstly, baseline surveys undertaken by the project team at the outset of activities in each city provide essential data on waste generation and management practices and conditions. Secondly, following the establishment of waste-to-resource facilities in each city, operational data was collected on a monthly basis allowing longitudinal analysis of the facility's progression towards financial sustainability (cost-recovery), as well as other variables. For this paper, data from operations over 2014 is utilised. Qualitative information is also presented based on a review and analysis of stakeholders across the four cities. This analysis sought to identify the resources that stakeholders control and how these can be mobilised within the setting of waste-to-resource projects.

Case study cities

The four case study cities utilised in this paper were selected from the pool of cities taking part in a programme led by UN ESCAP. It is in these four cities, Matale, Ratnapura (Sri Lanka), Kon Tum and Quy Nhon (Viet Nam), that the programme has been longest running, which has generated a considerable amount of data and experience. Key components of the waste-to-resource projects in these cities are presented below.

Waste generation and management

Baseline surveys undertaken in the case study cities at the outset of the project clearly indicate the dominance of organic and recyclable waste within the municipal waste stream. In all cities, the bulk of MSW is dumped or landfilled. Quy Nhon, the largest city by population, is the only city to operate a sanitary landfill. The other three cities rely on open dumping as the principal means for disposing of waste. Table 1 provides an overview of the generation and collection of solid waste in the four cities.

In all four cities, the informal sector plays an important role, in terms of waste collection, transport, on-sale and disposal. For example, in Matale, waste pickers collect over 80% of the total recyclable waste collected in the city (UN ESCAP, 2010).

Institutional landscape

In Sri Lanka, the Central Environmental Authority is the principal national regulating and enforcement agency for solid waste management, operating under the Ministry of Mahaweli Development and Environment. Under national legislation, and overseen by the Ministry of Local Government and Provincial Councils, municipalities are responsible for the management of MSW within their jurisdictions, including the collection, transportation, treatment and final disposal of municipal waste. In order to undertake these responsibilities, municipal councils receive funding made available via the provincial council from the Ministry of Mahaweli Development and Environment, which draws from the national budget. In addition, municipalities levy a waste collection fee

City	Population	Average MSW generated total (tons per day) ^a	Average MSW generated per capita (kg per day)	Collection rate (% of total waste) ^b	Organic fraction (% of total)	Start year of waste-to- resource facility	Capacity of facility (tons/day of organic waste)
Matale, Sri Lanka	40,674	21	0.51	72	71	2007, 2011, 2013º	9
Ratnapura, Sri Lanka	51,665	33	0.64	70	75	2013	5
Kon Tum, Viet Nam	145,383	91	0.63	70	65	2012	5
Quy Nhon, Viet Nam	271,248	189	0.70	83	61	2007	2

Table 1. Generation and collection of municipal solid waste (MSW) in the case study cities.

^aDetermined by directly measuring the average per capita waste generation from a representative sample of both residential and non-residential units over a period of 8 days and multiplying by the total population.

^bDetermined using data from formal municipal waste collection records and through assessments of informal sector waste collection activities.

^cThree waste-to-resource facilities have been established in Matale with a combined capacity of 9 tons/day.

Source: City governments and baseline surveys conducted by the United Nations Economic and Social Commission for Asia and the Pacific in 2010/2011.

from households and commercial units, although this is very modest and far from allowing cost recovery. In Matale and Ratnapura, solid waste management is the responsibility of the Public Health Department of the municipal council.

In Viet Nam, the leading policy institution at national level is the Ministry of Natural Resources and Environment, which issues regulations and standards to do with waste management in general, with the Ministry of Construction having specific jurisdiction over municipal waste management infrastructure, including the siting of landfills. Municipalities in Viet Nam are responsible for MSW management, and most municipalities undertake these responsibilities via state-owned Urban Environment Companies (URENCOs). URENCOs in both Kon Tum and Quy Nhon are tasked with waste collection, transportation, treatment and disposal.

Activities undertaken and partnership arrangements

In each of the four case study cities, UN ESCAP partnered with the local municipality and a range of other stakeholders to develop Integrated Resource Recovery Centres (IRRCs), based on the model developed by Waste Concern (Storey et al., 2013). An IRRC typically recovers various resources from waste through a combination of techniques, such as composting, anaerobic digestion, refuse-derived fuel or the collection of recyclables (for more information about the IRRC model and UN ESCAP's regional programme, please visit www.waste2resource. org). In the IRRC in the four case study cities, organic waste is converted into compost and sold to local farmers and households, while recyclable materials are cleaned and stored at the IRRC and sold to local recycling intermediaries.

In all case study cities, significant efforts have been made in preparing, establishing and maintaining the social, financial, regulatory and behavioural systems that are required to support the sustainable operation of the IRRC model (Storey et al., 2013). This has involved a focus on the development of partnerships between key stakeholders.

In Sri Lanka activities were implemented through a local NGO, Sevanatha Urban Resource Center, with the involvement of the Central Environmental Authority, the Ministry of Mahaweli Development and Environment, the Ministry of Local Government and Provincial Councils, as well as the municipalities of Matale and Ratnapura. Moreover, as part of the project Sevanatha has established a social enterprise, Micro Enriched Compost (MEC), to operate the IRRCs.

In Viet Nam activities were also implemented through a local NGO, Environment and Development in Action (ENDA) Viet Nam, with the involvement of the Ministry of Construction, the municipalities of Quy Nhon and Kon Tum, and the URENCOs and provincial governments in the respective municipalities.

In terms of capital expenditures, land was provided by the municipalities, while construction costs were covered though grants provided by UN ESCAP, except for one of the facilities in Matale, which was financed by the Central Environmental Authority of Sri Lanka. Table 2 outlines the essential stakeholder architecture for the operation of the model in each city.

UN ESCAP's regional programme has also sought to involve the informal sector in implementation. In other countries where the programme operates, waste pickers have been employed as workers of the waste-to-resource facilities, thereby providing them with higher and more stable income as well as better working conditions and health insurance. In the four case study cities discussed in this paper, workers also come from a poor and disadvantaged background but were not formerly employed in the informal sector. Project implementation has, therefore, sought to engage the informal sector in other ways. In Kon Tum, for example, waste pickers collect some recyclable items found in the mixed waste stream coming to the compost plant.

City	Ownership	Operation	Waste collection	Promotion of source separation
Matale	Municipality	MEC (social enterprise)	MEC (social enterprise) & municipality	Sevanatha (NGO) & municipality
Ratnapura	Municipality	MEC (social enterprise)	Municipality	Sevanatha (NGO) & municipality
Kon Tum	Municipality	URENCO (state-owned company)	URENCO (state-owned company)	ENDA (NGO) & municipality
Quy Nhon	Municipality	Community group	Community group	ENDA (NGO) & municipality

Table 2. Key roles in the operation of the waste-to-resource facilities in the case study cities.

Source: United Nations Economic and Social Commission for Asia and the Pacific.

NGO: non-governmental organisation; MEC: Micro Enriched Compost; URENCO: Urban Environment Company; ENDA: Environment and Development in Action.



Figure 1. Average share of revenue by source for Integrated Resource Recovery Centres during 2014. Source: United Nations Economic and Social Commission for Asia and the Pacific.

Revenue generation in waste-to-resource facilities

An analysis of revenue data from 2014 from each of the IRRCs shows that IRRCs depend upon a range of sources for revenues (see Figure 1). Importantly, revenue from compost is a relatively

minor contribution. In general, the sale of recyclables provides greater revenue than the sale of compost. The compost produced in the IRRCs in the four cities is high quality and subject to regular testing. Market analysis has provided guidance to IRRC managers in terms of buyer engagement and optimisation. Nevertheless, compost tends to fetch a low price on the market, due also to competition from a heavily subsidised chemical fertiliser industry particularly in Sri Lanka, and to a lesser extent in Viet Nam (Thang, 2014; Viet Nam News, 2012; Weerahera et al., 2010).

Figure 1 demonstrates the great extent to which the financial sustainability of the facilities depends upon revenue derived through other mechanisms (i.e. from sources other than the outputs of the IRRC). In Matale, Ratnapura and Kon Tum, municipal subsidy forms the principal revenue constituting between 76% and 81% of the facilities' revenue. Municipal subsidy is funds paid by the municipality to cover the cost of labour in the IRRC, or the cost of utilities such as electricity and water. Such a subsidy is agreed through negotiation with the municipality. On the other hand, in Quy Nhon the lion's share of the revenue derives from collection fees. The IRRC in Quy Nhon is the only one that performs primary collection of the waste it treats, except for one of the plants in Matale, where primary collection is provided in one neighbourhood. In Quy Nhon, around 800 households pay between USD 0.3 and 0.9 per month for collection. In addition, the local government has helped the IRRC to secure collection contracts with large establishments, such as hospitals and educational facilities. A single such contract can generate between USD 140 and 230 per month. In both Quy Nhon and Matale, waste collection fees are collected by the IRRC operator through the municipality in return for the primary waste collection service they perform. In Matale and Ratnapura any profit generated is shared between MEC (the operator) and the respective municipality. In Quy Nhon all profits are shared within the community group that operated the IRRC, while in Kon Tum any profit made is kept by URENCO (the operator).

Creating revenue streams to cover operational costs is a challenge and requires long-term and sustained engagement with a range of stakeholders. Partnerships on waste management projects are seen as even more critical in developing countries, where public funds and expertise are often lacking (Forsyth, 2005). For many cities, the financial performance of waste management is considered the key to sustainability (Ren and Hu, 2014). Our research highlights the key role that partnerships play in the sustainability of waste-to-resource initiatives in developing countries and, in particular, in secondary cities and small towns.

Findings and discussion. Experiences in the four case study cities show that effective partnerships between a diverse range of stakeholders are essential for the long-term sustainability of waste-to-resource initiatives. In each of the case study cities, different stakeholders access and mobilise different resources. A key element of establishing waste-to-resource initiatives in these cities involved leveraging partners' resources and commitment.

Framework conditions in each city differ in regards to policy, legal, institutional and financing arrangements, behavioural and cultural identities and technical know-how. This requires partnership arrangements to be tailored to reflect the specific circumstances in each city. Nonetheless, certain similarities are identifiable, particularly in terms of the resources that different types of partners can access and control. The word 'resource' is used to denote both tangible and intangible assets that the partner controls or can mobilise. Land is a resource, as is the trust of a community.

Based on experiences in the four case study cities, Table 3 sets out the various common resources that partners can typically access and mobilise, and the ways in which these resources can be leveraged to contribute to the long-term sustainability of waste-to-resource initiatives.

The following presents findings on how effective partnerships can be designed in order to address two main challenges related to waste-to-resource initiatives in developing countries, namely behavioural change and financial sustainability.

Changing behaviour and practices

Waste-to-resource initiatives require significant and sustained behavioural change, which is difficult to achieve. The quantity and quality of the outputs of waste-to-resource facilities relies upon the provision of 'clean', separated waste and, for this, households, markets, restaurants and other commercial units need to practice waste separation at source. In particular, waste separation is a critical element of the composting process as it is only through waste separation at source that quality, non-contaminated feedstock can be obtained (European Commission, 2004). Behavioural change does not happen overnight and requires a long-term and comprehensive strategy, which relies on the contribution from different partners. Changing behaviours within communities involves understanding, knowledge and awareness - and motivation to change (including incentives). This requires effective communication and information to be disseminated to the community on a regular basis. The key issue here is pursuing incremental but meaningful changes in behaviour and perception in order to achieve tangible results for waste management.

Municipalities have an important role to play. They can drive change by launching source separation programmes and awareness campaigns. Quy Nhon, for example, has instituted an annual 'recycling day', with various activities involving schools, businesses and neighbourhoods. Municipalities can also mobilise their human resources and establish communication channels, in particular at the ward level. In Matale and Ratnapura the municipalities have mobilised their Community Health Officers, who were already regularly providing health-related information to households, to raise awareness on the need to separate waste at source. In Quy Nhon and Kon Tum, instead, a specific network of communicators at the ward level was instituted for this purpose.

NGOs have also a key role to play. In the case study cities' NGOs typically maintain close relationships with communities and often receive a high degree of community trust. They can organise communication campaigns, produce information materials and also provide training and capacity building to communicators at the community level. Such experiences have proven to be transferable through South–South mechanisms. In Viet Nam, ENDA Viet Nam has conducted training and regular review meetings and refresher sessions with the network of communicators in both Quy Nhon and Kon Tum. Similarly, in Sri Lanka Sevanatha

Partner	Possible resource	Contribution to waste-to-resource initiative		
Community level				
Households, markets and commercial units	Solid waste	 Generate clean separated organic waste as a key input to the waste-to-resource facility Generate clean recyclables 		
	Private earnings	 Denerate clean recyclables Pay to have the waste collected 		
Non-government organisation	Community trust	 Fay to have the waste contected Encourage communities to separate waste through education, awareness raising and mobilisation Build knowledge and understanding of 3R 		
	Community presence Informal sector access	 Familiarity with local conditions and community needs Mobilise waste pickers for waste collection of organic and recyclable waste 		
Ward governments	Community truct	Encourage communities to congrate waste		
Waste pickers	Access to waste	 Use know-how regarding waste collection Collect recyclables from households 		
	Quality feedstock	 Deliver source-separated waste to IRRCs 		
	Market knowledge	 Prepare recyclables and sell them to middle agents Utilise trade and transport systems for waste Know and understand local markets 		
Municipal and provincial level				
Municipal government	Regulatory power	 Seek to support waste-to-resource initiatives through local policy and bylaws Support compliance with waste-to-resource initiatives Initiate programmes focusing on 3R Set collection fees and related taxes 		
	Land	 Provide site for the waste-to-resource facility 		
	Political legitimacy	 Encourage compliance with the initiative Motivate partners 		
	Public funds	 Provide financial resources for the establishment and operation of waste-to-resource facilities (including through subsidy and gate fees) 		
	Human resources	 Mobilise communicators to raise awareness on 3R Provide workers to the waste-to-resource facility 		
	Parks and green space	• Buy compost produced in the waste-to-resource facility for park and green space maintenance		
	Waste collection	 Collect and transport separated waste correctly 		
Waste management	Facility operations	 Pursue sound management of the facility 		
company	Waste collection	 Collect and transport separated waste correctly 		
Provincial (district) governments	Regulatory power	 Ensure compliance with waste-to-resource initiatives Initiate and set policy focusing on 3R Set collection fees and related taxes 		
National and international level				
National governments	Regulatory power	 Initiate and set policy focusing on 3R Setting regulations and quality standards for compost 		
	Market intervention	 Stimulate markets for waste-to-resource products (e.g. promoting the use of compost, or setting feed-in tariffs for waste-to-energy) 		
	Public funds	 Provide funds for the construction of waste-to-resource facilities 		
Multilateral and bilateral development agencies	Networking	 Provide platforms for the sharing of knowledge, experiences and best practices among countries and cities 		
	Technical knowledge	 Provide technical assistance, training and expertise to design and implement waste-to-resource policies and initiatives 		
	Climate financing	 Mobilise financing to support waste-to-resource initiatives that contribute to climate change mitigation 		

Source: United Nations Economic and Social Commission for Asia and the Pacific.

3R: reducing, reusing and recycling; IRRC: Integrated Resource Recovery Centre.

has trained the local Community Health Officers in Matale and Ratnapura and helped organise the communication campaigns.

Raising awareness is necessary but often not sufficient. While households and commercial units may demonstrate a general willingness to cooperate, unless clear incentives and disincentives are incorporated into the design of programmes for the segregation of waste at source, most households will simply mix waste. Disincentives and penalties can help enforce directives. For example, the municipality of Quy Nhon enforces a 'no separation, no collection' policy with commercial units, and can also revoke business permits after repeated violations. On the other hand, imposing penalties and fines on households is more challenging, and often politically unfeasible in developing countries, so the use of incentives may be considered more effective instead.

Surveys conducted among residents of the four case study cities have shown that households are willing to separate the waste and even to pay higher waste collection fees, provided they receive better collection services. Incentives for source separation may include expanding collection services or rethinking their frequency and timing to better suit the lifestyle and needs of households in communities that effectively separate waste. Such incentives proved effective in the case of the Nhon Ly commune in Quy Nhon, where participation in source separation at the household level increased from 9% in August 2013 to 36% by June 2014, following the improvement of waste collection services. It should be noted that waste separation rates could not be increased further, as the majority of households in the commune practice home composting.

In addition, source-separated waste must be supported by an appropriate waste collection infrastructure. Waste collection trucks, carts and bins should all maintain the separation that households have begun; if waste collection units re-mix waste, households will rapidly, and understandably, become disheartened. Similarly, workers themselves can be incentivised to maintain waste separation. In Quy Nhon, for example, recyclable materials that are gathered through source-separated collection are sold by IRRC workers who split the profit. All these strategies require close collaboration between the municipality, the waste collection company and communities.

long-term alternative sources of revenue for the facility and mobilising support around these.

The municipality has a key stake in ensuring that waste-toresource facilities are sustainable. Diverting waste from landfill not only improves the overall health and environment in the city, but it also directly reduces the costs of solid waste management for the municipality. In Quy Nhon, for example, the cost of waste transport and disposal amounts to VND 752,000/ton (USD 36.1). Part of these savings can be redirected to support the operations of waste-to-resource facilities, creating a win–win scenario. For example, the municipalities of Matale and Ratnapura directly subsidise the operations of the facilities by paying for the salaries of the manual workers. In Kon Tum, the operations are also partly subsidised by the municipality, which agreed to allocate a portion of the waste collection fees levied on the communities served by the IRRC to the operations of the facility. Moreover, a gate fee of VND 50,000 (USD 2.4) per ton is paid to the IRRC.

Revenues may also be generated by providing waste collection services and charging a corresponding fee to households and business units served. In Quy Nhon, for example, the IRRC collects waste from households within its ward, as well as organic waste from a nearby hospital. Allowing the waste-to-resource facilities to collect waste requires agreement between the operator of the facility, the municipality and the entity in charge of collecting waste in that city, whether public or private. However, municipalities may not always have the authority to set tariffs for the services they provide. In Viet Nam, for example, waste collection fees are set by the provincial government. Therefore, dealing with regulatory constraints requires engagement and collaboration of higher levels of government. Achieving regulatory support at that level greatly reduces inevitable policy bottlenecks and enhances the sustainability of the project on the ground.

National government can also play an important role in promoting waste-to-resource initiatives at the local level and in ensuring their financial sustainability. Governments can develop national programmes to promote the establishment of waste-toresource facilities. In Sri Lanka, for example, the national waste management programme known as the *Pilisaru* Programme has adopted the IRRC model and is actively promoting waste-toresource facilities in the country's municipalities. Under this programme, 115 composting facilities and 21 biogas plants have

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