

Grant Proposal

Social processes in post-crisis municipal solid waste management innovations: A proposal for research and knowledge exchange in South Asia

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Abstract

Municipal solid waste management (MSWM) has become one of the most pressing environmental issues in South Asian cities, the more so as it is closely linked to drinking water quality, sanitation and human health affecting mostly the urban poor, as well as to global climate change. Looking at recent governance initiatives in three South Asian cities developed in the wake of natural or human-induced crises, the project will focus on how to render MSWM improvements politically feasible and socially acceptable, which is a pre-requisites for functioning SWM systems, and thus for (environmental and social) sustainability more generally. The goal of this project, therefore, is to identify, analyze and promote the political and sociocultural processes that are necessary to enable the functioning of MSWM systems. In particular, alternative practices and systems are

promoted, whereby institutional hierarchies are decentralized, favoring horizontal accountabilities and whereby waste chains are shortened and transformed into closed loops implying a more circular waste economy in which both environmental and local livelihood benefits would accrue. The project puts emphasis on mutual learning through horizontal South-South partnerships between local authorities, civil society actors and researchers across South Asia.

Keywords

Solid Waste Management, Environmental Governance, Urban Political Ecology, South-South Partnership

Problem statement

The issue

The South Asian region, home to nearly one quarter of the world's population, is witnessing fast urban growth, economic development and growing consumerism resulting in rapidly increasing amounts of municipal solid waste (MSW)*1 that are expected to nearly triple between 2010 and 2025, representing the highest regional waste growth rate (Hoorweg and Bhada-Tata 2012). At the same time, open dumping continues in many cities, garbage collection remains incomplete and processing facilities are deficient, leading to a wide range of local environmental problems, including air pollution from open burning of garbage, olfactory nuisances near and in residential neighborhoods, pollution and clogging of water bodies due to open dumping and littering, soil and groundwater contamination through leachates from landfills (UN-Habitat 2010). The combined local impacts of inadequate municipal solid waste management (MSWM) render it a 'cumulative' global environmental issue (Turner et al. 1990) due to the ubiquity of the problems they cause. Furthermore, climate change and effects of greenhouse gas emissions have made MSWM a 'systemic' global environmental challenge (Turner et al. 1990). Inappropriate MSWM practices, such as improper incineration and uncontrolled disposal of wastes, are major contributors to greenhouse gas emissions; the anaerobic degradation of waste in landfills, for instance, produces significant amounts of methane (Kumar et al. 2004, Marxsen 2001).

The 'waste problem' has also become one of the most pressing social issues in South Asian cities, as it is closely linked to drinking water quality, sanitation and human health affecting the urban poor the most and implying spatial inequities and socio-environmental injustices. Furthermore, MSWM policies and practices have a direct impact on employment opportunities and livelihoods, particularly on those of poor men and women in the informal sector, as formalization efforts have diverse effects on incomes, job security, occupational health and the decency of work (Ahmed and Ali 2004, Wilson et al. 2013).

The proposed project is timely, as South Asian governments and civil-society organizations at different levels have started to pay primary attention to the problem of MSWM. Proper waste management is a key policy issue for municipalities, in particular, which are in most cases responsible for solid waste management and spend as much as 20-50% of their budget for this task (UNEP 2009).

Mainstream responses and existing research

(Local) governments in South Asia, as elsewhere, often respond to the challenge of MSWM by trying to adopt the approach of Integrated Solid Waste Management (ISWM), based on the '3R principle' (reduce, reuse, recycle)*2 and the advocacy of scientific methods of segregation, collection and safe disposal (Ramachandra and Bachamanda 2007, UNEP 2009). ISWM aims to decrease the volumes ending up in landfills or incinerators, to recover materials with economic value and to manage the remaining wastes effectively (Shekdar 2009) giving emphasis to engineering, 'modern' management and 'good governance' principles (Cointreau 2001, Tchobanoglous et al. 1993). Such technical-institutional systems – in many cases centralized ones, which proved successful in industrialized countries –are promoted by international donors, "sold" by transnational private firms and imitated by municipalities, often regardless of their technological appropriateness, local capacities, financial viability, institutional fit and socio-political feasibility (Zurbrügg et al. 2012).

In response, a large body of scientific literature on MSWM in developing countries has emerged that examines locally appropriate technologies for waste disposal, collection and transportation in the context of given urban spatial patterns, infrastructure, ecology and waste composition (Pokhrel and Viraraghavan 2005, Thomas-Hope 1998, Troschinetz and Mihelcic 2009, Zhu et al. 2007). Most of these studies are also concerned with the issues of financial viability and formal institutional-organizational designs of MSWM systems; for example, by evaluating community-based, decentralized management systems (Zurbrügg et al. 2005, Zurbrügg et al. 2004) or making the case for participatory and co-management approaches (Gutberlet 2010). Other studies assess neoliberal policies, particularly the possibility of formal public-private partnerships in solid waste management (Ahmed and Ali 2004, Miraftab 2004). The mainstream literature assesses the environmental performance of MSWM systems from the point of waste generation to its final disposal through life cycle analysis (Lundie and Peters 2005, Gentil et al. 2010, Yadav and Samadder 2014) and attempts to measure technological, economic and managerial efficiency (Vishwakarma et al. 2012).

Research gap

However, it is increasingly acknowledged that the MSWM problem goes beyond technological, formal-institutional, managerial and financial issues to include 'issues of social mobilisation and acceptance' or a 'social element' (Zurbrügg et al. 2012). Yet, this 'social element' is rarely problematized in conventional SWM studies but rather treated as a black box or simply referred to as a problem of 'awareness and attitudes' (Zhu et al. 2007).

Similarly, 'social mobilisation' or popular participation, as well as tensions and conflicts between stakeholders in the MSWM system, are rarely seen within a broader political context or as embedded in informal (everyday) governance structures (Corbridge et al. 2005). MSWM is therefore not only a 'global challenge for engineers' (Jayasinghe et al. 2013) but it also necessitates an understanding from social science perspectives.

In order to fill this gap, the proposed project will focus on sociocultural and political processes at various scales that determine the development of socially acceptable and politically feasible MSWM systems. To this end, we can build on a nascent literature that puts power relations, politics and governance at the center of the analysis on MSWM (Acuto 2014, Bjerkli 2013, Cornea et al. 2016, Demaria and Schindler 2015, Hartmann 2012, Moore 2009, Parizeau 2015a, Yates and Gutberlet 2011) and on emerging studies on sociocultural imaginaries of waste and their influence on the social acceptability of particular MSWM practices (Jewitt 2011, Mawdsley 2004, Moore 2012, see below).

Unlike most of the conventional SWM studies, furthermore, the proposed project will examine the emergence of new SWM governance initiatives by diverse actors, including governments, municipalities, private actors, NGOs and community organizations, rather than focus on well-established, externally promoted and formal MSWM systems. In particular, we look at SWM initiatives that emerged spontaneously and endogenously in response to natural and human-induced crises, such as natural disasters, garbage strikes, etc. These moments of crisis offer 'policy windows' (Kingdon and Thurber 1984) and often induce or enable new initiatives and fundamental changes of MSWM that may be more adapted to local and national political and sociocultural conditions than externally promoted and imposed MSWM systems. The analysis of such post-crisis (governmental, civil society or private) initiatives may therefore hold lessons on how to develop socially acceptable and politically feasible MSWM systems.

Hypotheses and objectives of the project

Assumptions and hypotheses

MSWM policies and projects in South Asia and elsewhere in the developing world have been strongly influenced by international financial institutions focusing on green environmental agendas, 'good governance' and the large-scale private sector (Marshall and Farahbakhsh 2013). The promoted systems generally depend on many actors along both the waste and the institutional chain and on their coordination within clear regulatory frameworks. They are therefore hardly adjusted to the political and sociocultural realities of governance in South Asia (Narayanan et al. 2012) with the effect that the deriving policies and regulations rarely translate into sustainable action on the ground.

Political processes (opportunities, incentives and pressures) and sociocultural processes (attitudes, sensitivities, imaginaries and discursive practices regarding garbage – also influenced by social class, caste and religion) influence the choice and implementation of MSWM systems in South Asia (Chaturvedi et al. 2015, Colon and Fawcett 2006). Locally

developed post-crisis initiatives may hold important lessons for the political feasibility and social acceptability of MSWM reforms as they tend to be based on forms of vernacular and everyday governance. Furthermore, MSWM systems with decentralized institutional hierarchies, favoring horizontal and downward accountabilities (Véron et al. 2006) and interactions of mutual trust among a limited number of actors, appear to be adapted to the political-cultural context. Together with shortened and circular waste chains, these may result in more spatial equity in terms of service delivery and the distribution of environmental pollution and risks within the city. Discursive practices representing waste and waste-work in a more positive light may furthermore facilitate changing attitudes towards particular waste practices, such as household segregation, and towards poor waste workers. In sum, decentralized MSWM with circular waste chains accompanied with pro-poor discourses may represent useful alternatives to globally promoted ISWM approaches as they combine technological appropriateness, institutional-cultural suitability, political feasibility, social acceptability, economic viability and an orientation to poor people's livelihoods.

Project aims and objectives

The goal of this project is to identify, analyze and promote the political and sociocultural processes that are necessary to enable the functioning of MSWM systems and to assess the opportunities in MSWM governance to strengthen horizontal and downwards accountabilities in combination with localizing the material waste chain and rendering it more circular. To reach this aim, recent post-crisis governance initiatives in Kerala, Sri Lanka and Nepal will be systematically examined. The different SWM initiatives will be examined with a focus on political and sociocultural processes and evaluated in terms of their extension to different contexts and of their potential for scaling-up. In this way, the project aims to contribute to global sustainable development, with a focus on its social and environmental dimensions. The general objectives of the project include:

1. To analyze the institutional architecture of waste governance, the waste chain and related socially differentiated labor practices, and accompanying discourses on waste and waste-work in three cities in Nepal, Sri Lanka and Kerala. Particular attention will be paid to selected recent post-crisis SWM initiatives that created stronger horizontal and downwards accountabilities and localized waste cycles and to the political and sociocultural processes at the household (including gender role), neighborhood and municipal levels that facilitated their development.
2. To assess the potential for extension to other location and scaling-up of successful governance initiatives in order to promote environmentally sustainable, livelihoods-oriented, gender sensitive, politically and socially appropriate, feasible and acceptable MSWM systems with circular waste chains and economies based on the created knowledge on post-crisis SWM initiatives.
3. To facilitate mutual learning and use knowledge generated through this study through horizontal South-South partnerships between local authorities, civil society actors and researchers across South Asia and through the organization of exchange visits, integrative forums, round table debate and the development of

policy briefs, synthesis papers, video logs and YouTube clips. The project will provide evidence to policymakers, practitioners, profit and non-profit organizations about alternative MSWM practices and systems, which have evolved endogenously in the wake of crises, and their appropriateness, feasibility and acceptability in particular political and sociocultural contexts. In turn this will stimulate the discussion, the co-design and the experimentation of new MSWM approaches including those that imply stronger horizontal and downward accountability structures and more localized waste cycles.

Theoretical and analytical framework

Towards and urban political ecology of waste

The planned research will contribute to the nascent body of literature on political and sociocultural dimensions of SWM through the application of an Urban Political Ecology (UPE) approach to examine and evaluate diverse post-crisis MSWM initiatives in different contexts with a focus on political and sociocultural processes.

UPE has emerged since the late 1990s as a distinct field within human geography and the study of human-environment relations (Bakker 2003, Kaïka 2003, Swyngedouw 1997). UPE regards cities as a “second nature” and as the dominant form of human living under the present capitalist system. It recognizes that urbanization is always an interconnected social (political-economic) and an environmental (physical-material) process and that cities are socio-environmental hybrids (Swyngedouw 1996). The general research agenda of UPE has been to uncover the political-economic processes, power relations, material and discursive struggles that produce current forms of urbanization, uneven urban spaces and differentiated access to resources and services in cities (Heynen et al. 2006, Swyngedouw and Heynen 2003), including with reference to natural disasters (Pelling 2012).

Marxist-oriented UPE studies emphasizing the influence of macro-level capitalist structures and national-level elites on local urban socio-environments have recently been complemented by poststructuralist approaches that highlight micro-politics and everyday practices of city-making (Lawhon et al. 2013, Loftus 2012, Shillington 2012, Truelove 2011, Truelove 2016) as well as approaches of multi-actor urban environmental governance across geographical scales (Cornea et al. 2017). Some authors, furthermore, pay particular attention to the politics of scale; that is, the perpetual negotiations about the level at which urban resources should be managed and at which environmental problems should be defined (Swyngedouw and Heynen 2003).

The topic of most UPE studies is related to urban natural resources and amenities (including water, urban land, lawns, forests and parks) for consumption, production and recreation. By contrast, the application of UPE to waste and pollution represent a relatively new and promising domain. In this emerging subfield, garbage and pollution are not simply seen as ‘environmental externalities’ but rather as constitutive of urban, social and political processes. For example, it has been shown how the distribution and the politics of air

pollution influenced urban spatial restructuring in Delhi (Véron 2006). Furthermore, waste is regarded as an element of urban nature that constitutes an important part of the human-environment metabolism, as demonstrated with the 'food waste - organic manure - urban agriculture' cycle in Diadema, Brazil, for example (Yates and Gutberlet 2011).

UPE and political dimensions of MSWM

An emerging UPE of waste underlines the importance of its hazardous character that influences the way in which it can be used as an instrument of power. For example, marginalized groups in Oaxaca, Mexico, blocked the transportation and disposal at a landfill; the accumulation of unhygienic and smelly garbage in the city, including in its more prosperous parts, put effective political pressure on the municipality (Moore 2009, Moore 2008). In West Bengal, efforts were made to clean up cities as a strategy to build political capital, particularly just before municipal elections (Cornea et al. 2016). These and other cases (Fredericks 2018, Darwish 2018) demonstrate the interconnectedness of physical-material and socio-political processes and the fact that garbage can also represent a political 'resource'.

Furthermore, the political ecology of waste in cities of the global South points to the uneven distribution of 'environmental bads', that is, the spatial correlations and the causalities between social and environmental marginalization within cities and between urban, periurban and rural areas and high- and low-income settlements. For instance, the urban poor in Accra bear the largest rubbish burden because of spatially uneven investment in municipal waste collection that is connected with the city's rapid growth and globalizing economy (Baabereyir et al. 2012).

The UPE of waste also underlines how improved waste management systems may be undermined, hindered and obstructed by local politics characterized by 'uneven power geometries' (Yates and Gutberlet 2011). In a recent study on West Bengal, it is shown how state-level government officials attempted to enforce national MSWM guidelines, including household-level waste segregation, through informal means. Political constraints at the municipal level and the fear of losing 'popularity', however, hindered the implementation of this scheme in most neighborhoods, except where an acting councilor felt free from the pressures of electoral politics (Cornea et al. 2016). Finally, recent studies highlight the interconnections between the global and the local scales of MSWM and the circulation of power and ideas (Demaria and Schindler 2015, Campos and Zapata 2014). These and other UPE studies reflect a concept of governance that goes beyond the normative, depoliticizing notion of 'good governance' (Bjerkli 2013, Narayanan 2008) to pay attention to tensions and conflicts between different institutions, organizations and stakeholders in the MSWM system.

UPE and sociocultural dimensions of MSWM

As mentioned earlier, the issue of social acceptability is often reduced to a lack of awareness (i.e., ignorance) of local residents. However, environmental awareness or

knowledge do not necessarily translate in environmentally friendly SWM practices, such as waste reduction, recycling or composting (Desa et al. 2011). Apart from practical considerations, waste behaviors also depend on social and cultural attitudes, taboos, sensitivities and imaginaries (Jewitt 2011). Indeed, waste is not only a physical matter generated in processes of production and consumption, but equally a social construction created within a broader cultural context (O'Brien 1999). For effective awareness raising among city dwellers, therefore, it is necessary to better understand the different stakeholders' (including the researchers') sociocultural imaginaries, associations and perceptions related to garbage.

Parallel to its attention to society-environment relations, UPE has therefore started to consider human-garbage relations. In a useful typology of waste concepts, for example, it has been suggested that development agencies generally view waste as a 'manageable object', (northern) environmental justice movements tend to see it as a 'hazard', and (researchers working on) scavengers speak of garbage 'as a resource' (Moore 2012).

Furthermore, South Asian societies are highly stratified not only by class and religion, but also by caste. As segmentation lines in society stratified by caste run along conceptions of purity, waste-work at an individual, household and societal level is inherently entangled with the allocation of such work to certain groups of people (Beall 2006). Furthermore, there is a link between the idea of waste or dirt as 'matter out of place' (Douglas 1966), Hindu-Brahmanical concepts of personal purity and caste pollution and the environmental attitudes of India's middle classes to only care about cleanliness in the private sphere (e.g., house compound) while being indifferent about one's rubbish littering public space (Mawdsley 2004). Building on these insights from the literature, this research acknowledges that waste imaginaries are embedded in broader cultural values, but the role of religion is contextualized in local social practices, relations and intersectionalities, thus avoiding essentialist views of interpreting Hinduism, Sinhala Buddhism, Christianity or Islam as ideologies that are either inherently eco-friendly or eco-unfriendly (Mawdsley 2004, Swearer 2006).

Apart from values, waste behaviors (e.g., littering) are linked to social norms, particularly in public places (Cialdini et al. 1990). Related SWM governmentalities and technologies of power remain understudied in UPE, unlike in the case of water (Mawdsley 2009, Rattu and Véron 2015, Rattu and Véron 2016). Yet this represents a potentially rich field for the proposed research as attempts to control public littering through video-surveillance and environmental police forces have been made in Sri Lanka and India.

These and other studies on the sociocultural dimensions of waste are important steps to investigate the 'social element' that often facilitates or hinders the adoption of particular MSWM practices and systems.

Some UPE studies are also concerned with labor and livelihoods, particularly in the informal sector (Gidwani 2015, Parizeau 2015b, for a review see also Millington and Lawhon 2018), a topic that has received much attention in scholarship on South Asia. Thousands of urban dwellers in India make their living upon wastes in many small

industries, using plastics, tin cans, cardboard, bottles, bones, hair, leather, glass and metal recovered from MSW (Gill 2009, Ambat 2003). There are important links between poverty, livelihoods and recycling activities (Gutberlet 2010, Ambat 2003), and more than 90% of the waste workers are women from economically and socially disadvantaged groups (Rengarajan 2013). In Nepal, informal recyclers including children have been found socially excluded and vulnerable. In Sri Lanka, waste pickers play a key role in waste removal from cities where they provide recyclable materials to formal enterprises, supply recyclable materials to informal businesses, private individuals and the general public. In this way, they contribute to the local economy, to public health and safety and to environmental sustainability (Smythe 2011). Hence an ongoing policy debate is about whether or how to integrate the informal sector into municipal waste systems: some argue that formal collective organizations of waste pickers can result in better wages and working conditions (Samson 2015) while others point to the exploitation of workers by formally appointed private contractors and to the exclusion of informal waste workers from important economic resources in the form of recyclable and other wastes (Demaria and Schindler 2015, Gidwani 2015). Yet, there is a broad consensus that MSWM reforms need to pay attention to their implications for informal waste pickers (Gill 2009, Fahmi 2005, Gutberlet 2008, Mitchell 2008); in other words, they need to be 'socially appropriate'.

Analytical framework

For the empirical study, the overarching UPE framework needs to be complemented and operationalized through mid-level concepts. Starting from the UPE premise that urbanization is an interconnected political-economic and physical-material process that creates uneven urban spaces and unequal access to resources and services, the proposed research examines a coupled system with three interrelated elements: (i) the institutional architecture with flows of ideas, funds and power; (ii) the waste chain characterized by material flows and human labor; and (iii) the discursive construction and representation of waste and waste-work.

Institutional architecture

The institutional architecture refers to the constellation of governmental agencies and non-governmental stakeholders, legal and policy regimes and political forces in a given spatial and temporal context. Thereby, we will also consider informal aspects such as particular practices of exchange and transaction, including patronage or rent-seeking practices pertaining to the SWM sector. This research will adopt a perspective of governance that is shaped by this local embeddedness as 'vernacular governance' (Sundaresan 2017) or as 'everyday governance' (Cornea et al. 2017). This view posits that mechanisms of governance take very place-specific and culturally differentiated forms in terms of their rationalities, technologies, actors and processes.

Fig. 1 represents a largely hierarchical institutional architecture of flows of ideas, funds and commands. In the center stands the municipality, the institution responsible for MSWM, whose practices however are determined by higher-level governments and global (expert)

discourses, as well as influenced by interactions with local-level actors (e.g., resident associations, NGOs, private providers). Noteworthy are the inherent scale issues as well as the fact that a number of important MSWM providers (e.g., parastatal special purpose entities or the private sector) escape direct downward accountabilities. Of course, the relative importance of the different actors and the actual flows of power, funds and ideas have to be identified through empirical research in the studied countries and cities.

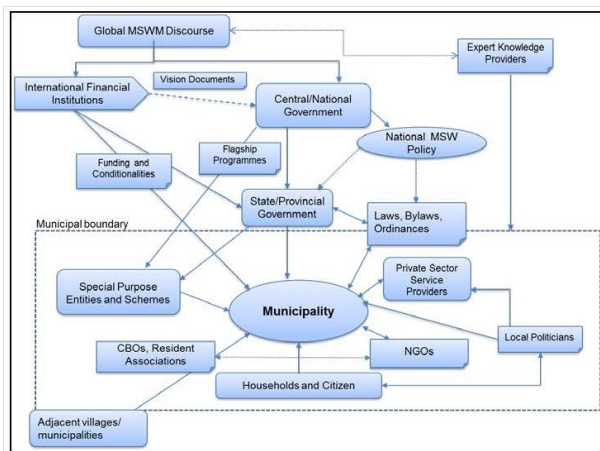


Figure 1. doi Schematic representation of the institutional MSWM architecture.

Waste chain

Coupled with the institutional topography are the material flows of the waste chain, the waste practices and the labor applied to segregate, transport, recycle and dispose rubbish. The waste chain is conceptualized through the lens of urban metabolism –an understanding of the city as an organism that transforms resources (e.g., minerals, water, biomass, energy) into goods (e.g., buildings, piped water, food) but also into emissions and pollution (Gasparatos 2017). This concept not only focuses on the material and energy flow within and through the city, but also sheds light on the reproduction of social inequality through these flows and altered social relationships (Decker et al. 2000). UPE studies link the concept of urban metabolism with the circulation of power (Heynen et al. 2006). Hence, social and power relations are located at each point of the waste chain implying that the urban metabolism leads to an unequal accumulation of goods and services, as well as wastes and pollutions, in different parts of the city, often reinforcing spatial inequalities.

Fig. 2 represents a case where segregation at source and decentralized waste recovery and recycling are taking place. The study of waste chains are central as an empirical entry point for this research; institutional architecture and social discourses manifest and often materialize themselves in waste chains. The waste chain begins at the site of the waste generator (household, markets, shops, schools, offices, etc.) where it is stored and perhaps

segregated. Segregated or non-segregated waste is then either collected from door-to-door, or brought to community bins or dumped in open (public) spaces in the neighborhood or elsewhere. Informal waste workers often pick up valuable recyclables from the source or from bins and dumpsites; glass, paper, cardboard, plastics, etc. enter separate streams. Wastes are transported between primary collection points, secondary transition points and the disposal/treatment facility (open dumps, landfills, composting and recycling plants, incinerators, etc.). The actual waste chains have to be identified through empirical research in the studied countries and cities, and they are likely to differ within the same city, pointing to inequities and environmental injustices.

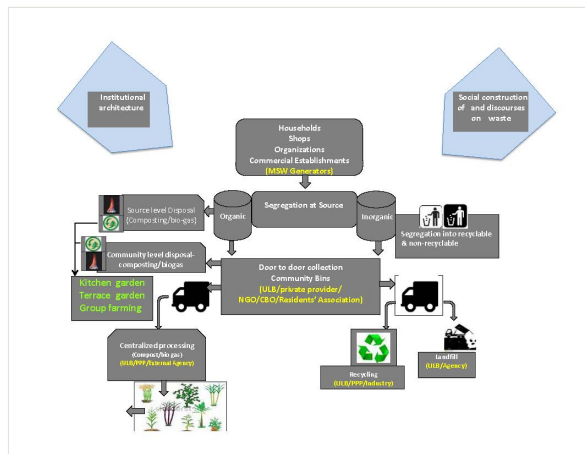


Figure 2. [doi](#)

Partly decentralized waste chains in Kerala.

Discursive construction and representation

The dialectic between political and physical-material processes is furthermore influenced by discursive practices. The discursive construction and representation of waste and waste-work points to the practice of referring to garbage in different ways. As we have shown above, waste is conceptualized differently by different groups of people, for example, as a hazard or a resource (Moore 2012). Often, waste is discursively constructed as filthy and disgusting material. This triggers affective qualities that it be removed from sight and from smell. This imperative to get rid of waste is generative of social practice and space (Moore 2009). Furthermore, the constructed filthiness of waste is often discursively extended to those handling garbage, which can lead to the stigmatization, marginalization and exclusion of waste workers (Nading and Fisher 2018). More generally, class values and beliefs in regard to waste are intrinsically linked notions of cleanliness and can bring to light a 'not in my back yard' (NIMBY) effect that is reproduced and perpetuated through the cityscape (Mawdsley 2004). By contrast, more positive discursive representations of waste-work may have the potential of breaking social taboos related to waste segregation and of promoting more dignified labor conditions in this sector.

To sum up, the focus on the political and sociocultural processes of MSWM initiatives allows for a more comprehensive explanation of the adoption of particular MSWM systems and a better diagnostic whether new approaches can be rendered politically and socially appropriate, feasible and acceptable. The planned research takes an original perspective that embeds solid waste in UPE and broader debates on the politics of human-environment relations, which in turn will be informed by the empirical studies in South Asia. Some of the related applied methods, such as waste diaries or waste mapping (see below), can also be considered relatively novel.

Methodology

Country, city and case selection

MSWM in South Asia represents a major challenge due to the region's rapid urbanization, economic growth, spreading consumerism and the large amount of unmanaged wastes. Waste production in South Asia is expected to increase 2.8 times between 2010 and 2025, representing the fastest growth among the world regions (Hoorweg and Bhada-Tata 2012). Furthermore, the production of municipal waste in South Asia is an important cumulative global environmental and social issue due to the region's demographic weight.

Within South Asia, we selected Nepal, Sri Lanka and India as they represent different types of post-crisis SWM governance initiatives (see below) that allow for comparisons as well as for regional (S-S) cooperation and horizontal learning (further aided by the relative geographical proximity). Furthermore, their similar demographic and socioeconomic characteristics allow an assessment of the relative influence of different types of politics, governance and sociocultural imaginaries on the management of waste. MSWM has also gained importance on the policy agenda and in the political debate in these three countries, as their urban areas are very densely populated, where 'free spaces' for open dumping are becoming scarcer and where urban transitions are underway in terms of institutional reform, changing lifestyles and new environmental imperatives. The confluence of these trends has rendered municipal solid waste not only an environmental, but also a major social and political problem.

However, MSWM in the three selected countries is embedded in a different institutional architecture and reform process. In Nepal, for instance, the new constitution adopted in 2015 demands the transformation of the political system from a centralized to a strongly decentralized federal state. The devolution of powers to the local authorities will also have direct implications for MSWM. In Sri Lanka, attempts to create supra-municipal bodies for MSWM have been made, adding to the institutional complexity and rendering SWM governance difficult and often conflictual. Unplanned urbanization and post-conflict economic growth have furthermore led to lifestyle changes, implying an increase of inorganic waste by 20-30%. By contrast, Kerala (India) has a long-standing experience in the devolution of powers. Today, local authorities control a large part of the budget and establish their own plans, also regarding MSWM.

Within the selected three countries, we chose one urban area per country for in-depth empirical studies. The rationale for the case selection was the areas' richness and variety in recent crisis-triggered, endogenous SWM governance initiatives. However, the chosen urban areas are not viewed as homogenous spaces with ubiquitous (SWM) infrastructure and service provision, but as uneven, fragmented urban spaces where different (formal and informal) systems coexist and overlap in an institutional bricolage (Allen et al. 2015). Due to this form of 'splintering urbanism' (Graham and Marvin 2002), particular wards/neighborhoods are purposively selected to represent different socio-economic classes and ethnic groups, but also diverse urban (SWM) experiences of the households, institutional waste producers and public spaces. Emphasis is given to low-income settlements.

In Kerala, SWM has been addressed seriously for some time and more recently with decentralized, participatory approaches. The planned research will focus on the city of Thiruvananthapuram, which experienced a severe garbage crisis in 2012, as (party-politicized) protests by local residents forced the closure of the main waste processing (composting) plant in the nearby village of Vilappil. Garbage could hence not be disposed of and the stench from waste dominated the city. This garbage crisis encouraged the municipality to develop an innovative decentralized, community-based MSWM system. Women self-help groups (Kudumbashree) are employed for household collection and for raising the awareness for household-level waste segregation, and 'green technologists' appointed by the municipality give SWM advice to the residents. This MSWM initiative seems to have been highly successful in changing the behavioral habits of residents. Currently, about 60-70% of biodegradable wastes are treated at the household level (composting or biomethanation in small biogas plants). Other households can bring biodegradable wastes to decentralized neighborhood collection points. The initiative also addresses the issue of non-degradable wastes, particularly plastic bags and waste produced from large-scale events, with the support of the Green Protocol of the State of Kerala that prescribes "Dos and Don'ts" for the prevention of waste.

The inclusion of Kerala (India) in the research is necessary (even though the r4d programme does not target India) because of its regional significance as the site of seemingly successful, innovative recent governance initiatives in MSWM creating community-based, localized and circular waste chains and economies. The quality of the planned S-S knowledge exchange will be significantly enhanced through the full participation of stakeholders in Kerala in the project. Kerala also leads the way in terms of regional urbanization trends and consumption/waste patterns.

In Nepal, interesting SWM initiatives emerged in the Kathmandu Valley in the wake of the earthquake of April 2015 and the six-month Indian blockade starting in September 2015 inducing extreme scarcity of vital goods. Due to the fuel crisis and bad road conditions, garbage started to pile up in the cities. In response, small private companies appeared on the scene to collect household wastes door-to-door, representing a novel initiative of bottom-up privatization. The crisis also motivated neighborhood clubs to involve themselves in garbage collection and awareness raising. These initiatives have in some places become formalized into public-private or public-public/community partnerships for waste collection.

The planned study will focus on the neighborhoods of Maharajung (northern part of Kathmandu) and Panga (Kirtipur municipality, adjacent to Kathmandu). In Maharajung, local communities, supported by the local ward office and an NGO, have adopted the zero waste concept and promote waste reduction, reuse, recycling (composting) and recovery with a participatory approach. In Panga, a user-fee-based public-private partnership emerged in which a small local company organizes door-to-door collection, waste segregation in a collection center, composting and the sale of recyclables. Okharpauwa village, where many wastes from Kathmandu end up, will serve as a secondary research site is to study the issue of socio-environmental justice.

In the metropolitan area of Colombo, Sri Lanka, MSWM moved to the center of political attention in 2016, when the accumulated 'waste mountain' of a centralized dumpsite in Meethotamulla at the periphery of the city region suddenly collapsed. The ensuing landslide-like event killed 28 people, destroyed numerous houses and displaced 180 families. This crisis heightened the general awareness about the MSW problem and led to new ideas for waste-to-energy projects (incineration). For the time being, however, only other dumpsites have been expanded – even in ecologically sensitive locations near water inlets. Furthermore, a special police unit, the Environment Police, increased its efforts to enforce the preexisting strict non-littering laws and thus contributes to the disciplining of citizens in regard to waste practices (i.e., use of sorting waste bins in public spaces and waste segregation at source in their homes). The proposed project will examine these non-participatory, disciplinary, top-down initiatives in the Colombo metropolitan area in the Municipal Council of Dehiwala-Mt. Lavinia, a mixed neighborhood in terms of ethnicity and class composition and one of the largest low-income relocation site, and in the Municipal Council of Boralesgamuwa, where issues of spatial justice can be addressed as one of the largest dumpsite in the metropolitan area is located there.

The three described cases, which can be qualified as relative successes, are insightful in distinct aspects and at different analytical levels on how particular initiatives and context factors have contributed to positive MSWM outcomes. Thiruvananthapuram represents the most comprehensive initiative encompassing behavioral change at the household level, collection and treatment. It is led by the municipal corporation and supported by the state government, the state's decentralized institutional architecture, and community-based organizations. The initiative follows largely a participatory approach. Kathmandu's case is driven by bottom-up initiatives (private sector, community groups) and mostly limited to waste collection and waste reduction. The new partnerships defining MSWM practices may come to shape institutional understandings of MSWM in Nepal, where institutional reforms are underway. By contrast, Colombo offers a case to analyze top-down, disciplinary initiatives and a new discursive context demanding 'proper' behaviors of the citizens.

The above-mentioned variability in institutional architecture between the three countries represents a challenge for analytical comparison, as well as for mutual learning, extension to other locations and scaling-up. In order to address this problem, the project does not aim to identify universal 'key factors' or 'best practices' but rather to document the political and sociocultural processes in their broader institutional (national and local) context that facilitate the emergence of innovative initiatives. Through its orientation to processes, this

proposed research aims to identify particular constellations that positively influence MSWM outcomes and to map them against similar constellations elsewhere in the South Asian region in order to create South-South lessons of innovative MWSM arrangements and practices.

Methods of data collection

The empirical research objective to “analyze the institutional architecture of waste governance, the waste chain and related socially differentiated labor practices, and accompanying discourses on waste and waste-work in three cities in Nepal, Sri Lanka and Kerala” (project objective 1) contains three research components that will be approached through different methods and series of research questions (see below).

Generally, the project will apply a mixed-method approach to examine how the different SWM governance initiatives, mechanisms and systems came about in the three urban area. At the different stages of the research, semi-structured and in-depth interviews with the identified key actors (municipal, state/province, and national-level government officers, local and supra-local politicians, engineers, private contractors, NGO representatives, leaders of resistance movements, unions, waste-work contractors, waste collectors, residents’ associations, waste producers (men and women), etc.) will be used to understand political and sociocultural motives behind the adoption, modification or rejection of particular MSWM practices. Furthermore, focus group discussions will be carried out with groups of female and male waste producers, with communities affected by inadequate collection services or by nearby waste dumping, and with members of grassroots resistance movements.

The general research questions include: How did the particular crisis situation facilitate change? How and when were the initiatives implemented, resisted or shelved? What were the political and sociocultural incentives and processes for their adoption, modification or rejection? What processes led to socially equitable and environmentally sustainable MSWM outcomes?

Institutional architecture of waste governance

The mapping of the institutional architecture will be based on the review of existing literature and documents as well as expert interviews coupled with a stakeholder/social network analysis Lienert et al. 2013, for which the local municipal authorities will form the entry point, from where their formal and informal interactions with other authorities, other municipalities, political parties, private companies, residence associations, NGOs, CBOs, locality leaders, waste-work contractors and waste processors will be traced. The senior researchers of the project will conduct an ‘ethnography of the state’ Corbridge et al. 2005 drawing upon qualitative interviews with cooperative officers, including retired bureaucrats, elected councilors and other SWM governance actors, direct observations in offices and in the field. The institutional mapping, social network analysis and ethnography of the state

will form the basis for a political opportunity mapping with local stakeholders in the three countries. The disciplines involved for this task are: sociology, political science, geography.

Research questions will include: What is the hierarchical or decentralized institutional architecture of MSWM in the three countries at and between the national, state/provincial and municipal levels? What are the relevant legislations in force? What are the policies, projects and practices of local authorities in regard to SWM? How do they interact with other levels of government, other municipalities, political parties, private companies, residence association, NGOs, CBOs and communities? What is the political feasibility of alternative SWM systems? What is the level of coordination and collaboration between local authorities, especially for finding solutions to deal with final residues? What are the enabling and constraining factors for this collaboration? What are the political incentives or disincentives for local officials to promote circular waste practices at the household level and amongst institutional waste producers? What are the pressure groups (e.g., consultants, business groups, trade unions) that influence this and other policy choices? How can local (circular) accountabilities be created or reinforced?

Waste chain and related socially differentiated labor practices

The project intends to follow the waste chains from the producer to the final discharge or re-user of the selected waste. Particular attention will be given to the household level, markets and public spaces. The involved actors, institutions and conflicts along the waste chain will be mapped based on field observations, qualitative interviews and the analysis of secondary sources. Furthermore, innovative methods, such as participatory mapping and videography with waste workers and residents will be carried out to make sense of their understanding of the waste chain and to contrast it with the actual geography of waste. The shadowing of waste workers is also foreseen. Interviews will be conducted with officials dealing with waste, waste pickers, small traders and small enterprises active in the recycling sector (e.g., plastic recycling plants, providers of biogas technologies). GPS mapping of waste collection centers, littering spaces and landfills will provide a spatial sense of decentralization efforts and/or the clustering of waste in certain parts of the city. From this research objective the opportunity arises to do a socio-economic mapping. This task will involve the disciplines of geography, sociology, environmental science and engineering.

At the household level, a questionnaire survey on (gendered) waste practices in the purposively selected wards will be conducted by recent university graduates and community members in Colombo, by research assistants in Kathmandu and BTech and MTech college students in Thiruvananthapuram. In addition, the research team will make direct observations (during questionnaire interviews) for the purpose of triangulation and verification. The project team will also design a waste diary (for one week) which will be conducted by high-school students, boys and girls, first in their own homes and then in other households.*3 The waste diary has a double function as a method of both data collection and awareness raising. To study littering in public spaces, the innovative and

empowering method of participatory photography will be used with men and women of different social classes.

Research questions will include: What are the (linear or circular) waste value chains and gendered labor and livelihood conditions and power relations at the different parts of the chain? What are the waste practices (e.g., segregation and composting) at the household level (gendered approach) and by institutional waste producers (markets and restaurants)? What are the gender-, class- or caste-specific reasons of (non-) adoption of segregation or composting practices and what are behaviors in public places? What are the characteristics of the places where littering and dumping occurs? What technologies of government (e.g., video-surveillance cameras, environmental police, neighborhood patrolling, social control and self-discipline) are in place to control these practices? What are the different SWM systems applied in neighborhoods with different ethnic composition and legal tenure status?

Discourses on waste and waste-work

The above-mentioned household questionnaire survey will also include context-sensitively framed questions on affect and waste. Underpinning discourses on waste and waste-work will be identified through qualitative interviews and informal conversations with households of different social groups, waste collectors, 'green technologists' or 'garbage consultants' (in the case of Thiruvananthapuram) and the Environment Police (in the case of Colombo). Furthermore, discourse analysis of documents (incl. press articles), interview transcripts and waste diaries will be used to identify the (context-specific) sociocultural waste imaginaries of the different stakeholders in the waste chain. From this research objective the opportunity arises to do an awareness campaign considering the socio-cultural imaginaries on waste. This part will involve sociologists and anthropologists.

Research questions include: How is waste and waste-work discursively constructed, what affect does it produce? What discourses accompanied the successful shifts toward waste segregation at source? What cultural taboos and social norms could thereby be overcome? What would be culturally and politically appropriate models? How can successful models be extended to other geographical contexts?

In order to facilitate comparability, the project team will develop a common methodological framework with observation and interview guides and a list of interviewees. A common framework will also be developed for the recording, coding, management, storage, analysis and interpretation of the collected data.

Data situation

As our analytical framework will lead us to examine the material, institutional and discursive dimensions of SWM systems in each urban area, we are considering the related different types of available data. Regarding the material dimension, data on waste quantity and composition are by and large available (Pokhrel and Viraraghavan 2005, Asian Development Bank 2013, Asian Regional Research Program on Environmental Technology

2006, Ambat 2000, Ambat 2007, Bandara and Hettiaratchi 2010, Basnayake and Visvanathan 2013, Bhattarai 2003, Ambat 2003, Damodaran et al. 2010, Dangi et al. 2011, Gunawardana et al. 2009, Menikpura et al. 2012). However, these data are not comparable as such, as the measurement methods and the definitions of municipal solid waste differ among the three countries. Furthermore, data on the formal institutional architecture is partly available (Pokhrel and Viraraghavan 2005 Asian Development Bank 2013 Basnayake and Visvanathan 2013, Damodaran et al. 2010) but tends to be outdated quickly. However, information on informal governance structures and on the selected recent post-crisis SWM governance initiatives is largely not documented. Therefore, primary field research is required.

Recent experiments of decentralized SWM in Kerala are documented only partially, mostly on the city of Alappuzha rather than Thiruvananthapuram and in the vernacular language (Malayalam) (Isaac and Gopakumar 2014). Exceptions from this are grey-literature documentation from the Centre of Environment and Development and a Master's thesis (July 2018). The increasing policing efforts for waste segregation and against littering in Colombo are reported in newspaper articles (Anonymous 2017) but have not been examined in the scientific and development literature. No written information is currently available on the selected cases in Kathmandu and data availability on SWM in Nepal on general is scarce and contested.

Impact

Novelty of the approach and the created knowledge

The project will contribute to the r4d programme objectives (i.e., the generation of scientific knowledge and research-based solutions for reducing poverty and global risks in development countries; the provision of national and international stakeholders with methods and options for finding integrated, holistic approaches to solving problems linked to issues of global importance; the enhancement of scientific skills and know-how in dealing with the complexity of global problems for the benefit of societies in developing countries) through the creation of interdisciplinary knowledge and the examination of governance options regarding the complex issue of MSWM. Its focus on political and sociocultural processes through the lens of UPE is novel and thus will produce new policy-relevant awareness and insights on the political feasibility and the social acceptability of MSWM practices and systems. These are necessary for social transformation at the behavioral level of households (including towards gender equity), at the interactional levels between stakeholders in cities, and the institutional and policymaking levels. The emphasis on endogenous and mostly participatory MSWM will unveil alternatives for policymakers to the commonly promoted MSWM blueprints. Bottom-up transformations through increased awareness and sustainable and socially just waste chain logistics seem to be an option to create sustainable and more inclusive cities that are more oriented to the needs of poor people in the developing world.

The project aims to use participatory mapping, photography and videography, thus seeing MSWM through eyes of local actors and attempting to create awareness, not only about eco-friendly waste practices but also about waste-work, thus contributing to the ILO goal of promoting decent work within the waste sector. This methodology involving multiple stakeholders, such as private actors, neighborhood clubs and public institutions (e.g., schools), may prove effective in changing waste imaginaries and behavioral patterns, a prerequisite for sustainable SWM and may therefore be developed in protocols that are applicable beyond the project in development practice.

Furthermore, the project uses process documentation (see above) to assess the potential for extension to other locations and the scalability of positive SWM initiatives. This method puts emphasis on a detailed study of contextual factors of successful SWM governance initiatives in order to show policymakers both immediate and underlying social, institutional and cultural factors that are often overlooked in studies that focus on technological-institutional approaches on SWM but are often important obstacles for successful implementation.

Pathways to impact

The project is designed to have two interrelated pathways to impact: (1) through knowledge creation and dissemination; (2) through the facilitation of horizontal S-S knowledge exchanges (see Table 1 and Table 2).

Table 1.

Results framework (project outcomes).

Hierarchy of objectives Strategy of Intervention	Key Indicators	Data Sources Means of Verification	Assumptions
Impact (Overarching Goal)	Impact Indicators		
Widespread adoption of locally adapted, environmentally sustainable, gender-sensitive and livelihoods-oriented MSWM in South Asia.	Number of municipalities implementing decentralized MSWM with multiple technology options promoting circular waste chains and horizontal accountability structures	National and regional level reports, process documentation and evaluations	Circular waste chains, awareness efforts and horizontal accountability structures lead to locally adapted, environmentally sustainable and livelihoods-oriented, gender-sensitive MSWM Political and social acceptability are key determinants for the adoption of environmentally sustainable and livelihoods-oriented MSWM Endogenous SWM initiatives are politically and socially more acceptable and adapted than externally promoted models Horizontal (S-S) knowledge exchange brings about effective change

Outcomes		Outcome Indicators		External Factors (Assumptions & Risks)
Strategic Objectives	Improved and accessible knowledge on different MSWM systems and governance initiatives in South Asia, particularly in regard to their political and social feasibility and acceptability	Academic impact of research Policy impact of research Knowledge impact on stakeholders	Citation index, H-index Citations in policy documents Final stakeholder workshops; social media (qualitative assessments)	Different disciplinary backgrounds, career incentives, levels of experience and research capacities within project team Potential lack of incentives for international stakeholder (e.g., international financial institutions) to pay attention to local political and social factors of MSWM
	Effective horizontal South-South partnerships between researchers, civil society actors and local authorities across South Asia for mutual learning and capacity building on MSWM	Joint research and policy papers between academic and civil society partners and between country-level research teams Common public statements, press conferences, etc. between project team and local stakeholders (Mutual) adoption of and experimentation with elements of effective MSWM systems Key concerns of project on agendas of national, regional and international networks	Project database: number and type Project-initiated social media platforms and video-protocols: number and type Project database, qualitative assessment with municipal officials Publications of networks; conference programs	Predispositions of stakeholders to engage with the project Openness for mutual understanding and learning Limited duration of project

The project builds on a UPE approach, which understands human-society relations as dialectical and shaped by power relations. The research attempts to capture societal and material change in form of SWM initiatives that emerged in post-crisis situations and disrupted entrenched power relations and systems. The premise is that these endogenous initiatives hold lessons for more equitable, socially and politically feasible SWM than externally promoted approaches. And we assume that change can be fostered through the dissemination and exchange of knowledge on these initiatives.

Among the primary users, beneficiaries and stakeholders of our research, we have identified local authorities and other local stakeholders (residents’ associations, CBOs, NGOs, small and micro-enterprises and waste workers). These actors will be involved from the beginning of the project, which will give an opportunity to fine-tune the research objectives and hopefully generate a sense of ownership of the research. They will also be invited to share findings and translate them into practice throughout the project period.

Table 2.

Results framework (project outputs).

Outputs (per outcome)	Output Indicators	Data Sources Means of Verification	External Factors (Assumptions & Risks)	
For outcome 1: Improved and accessible knowledge on different SWM systems and governance initiatives in South Asia, particularly in regard to their political and social appropriateness, feasibility and acceptability				
Output 1	Publishable empirical research findings and new insights from the three country studies and the comparative analysis	Reports and working papers Peer reviewed articles Publication of jointly authored book Research presentations	Project database: number Number in regional/ international journals; H- index Yes/no Number in national/regional/ international conferences	Different disciplinary backgrounds, career incentives, levels of experience and research capacities, local networks of co-applicants
Output 2	Knowledge products in vernacular languages and in English for end users	Waste diary protocol for awareness-raising Video protocols for training purposes Textual protocols on MSWM systems and experiences Process documentation Video-logs of project activities Film documentary	Project database: Number and type of products	Possibility to assess impact beyond project period.
For outcome 2: Effective horizontal partnerships between researchers, civil society actors and local authorities across South Asia for mutual learning and capacity building on MSWM				
Output 1	Project-level platforms for knowledge exchange between academic and CSO partners and between the three country-level teams	Project meetings Joint research and communication activities	Project database: number and type of activities; quantitative and qualitative indicators of collaborative work	Predispositions of stakeholders to engage with the project Openness for mutual understanding and learning Time constraints of individual project partners
Output 2	Local platforms for knowledge exchange	Country-level stakeholder workshops and regular interactions Press Social media platforms	Project database: number and type of activities; quantitative and qualitative indicators of participation by different types of stakeholders Project database: number and type of platforms; quantitative and qualitative indicators of user involvement	Resource constraints Limited duration of the project
Output 3	Regional platforms of knowledge exchange	Exchange visits Project presence in regional and international forums Social media platforms	Number of presentations in regional and international stakeholder networks	

We expect that politicians and governments will be enablers of this project, as MSWM has become a top priority in South Asia in light of rapid urbanization. Furthermore, regional networks will facilitate the dissemination of project findings. Potential losers of the project include entrenched interests (large private companies and consultancies in the SWM sector, rent-seeking politicians). The project will pay particular attention to gender, as the segregation of waste at the household level risks to imply a higher workload, particular for women, domestic helpers and perhaps children (Table 1).

Links to the Sustainable Development Goals

MSWM is linked to multiple Sustainable Development Goals (SDGs) and needs to be considered as a cross-cutting global sustainable development issue. The project is directly linked to at least three SDGs: SDG 11 to build sustainable cities and communities, SDG 12 to ensure responsible consumption and production, and SDG 17 to strengthen partnerships. MSWM is a key component of sustainable and inclusive cities and SDG target 11.6 gives special attention to MSWM as a way to reduce the environmental impact of cities. The project aims to contribute to sustainable and equitable MSWM in South Asia. MSWM is referred to most explicitly in SDG 12: SDG target 12.5 directly calls for the reduction of wastes through prevention, reduction, recycling and reuse, and SDG target 12.4 refers to the environmentally sound management of all wastes. This project attempts to contribute to these goals through the promotion of localized, circular waste chains. More generally, the project contributes to the development of partnerships, particularly in terms of capacity building and the fostering of South-South exchanges (SDG target 17.9) (United Nations 2018).

Furthermore, MSWM is connected to SDG target 3.9 on water and soil pollution and contamination; SDG target 6.3 to improve water quality by eliminating dumping. It is also related to SDG 1 (reducing poverty) and SDG 3 (good-health and well-being) at the local level and to SDG 13 (climate change) and SDG 14 (conservation of the oceans) at a more global level. This project pays particular attention to promote livelihoods-oriented MSWM systems (as to contribute to SDG target 8.8 to promote safe working environments, particularly for those in precarious employment) and gender-sensitive systems (to contribute to SDG 5 for more gender equality) (United Nations 2018).

Synergies and tradeoffs between more ecology-oriented goals (e.g., minimizing resource loss in MSWM systems) and more socially-oriented goals (e.g., maximizing labor benefits and gender equality in MSWM) may arise in specific contexts.

Implementation

The project will run from November 2018 for four years. Academic partners in South Asia include the Indian Institute of Technology-Bombay, the Nepal Centre for Contemporary Research and the University of Colombo, and in Switzerland the University of Lausanne and EAWAG. The interdisciplinary team can draw upon approaches from geography,

sociology, political science, development studies and engineering. The academic team is complemented by NGOs (Centre for Environment and Development, Thiruvananthapuram; Centre for Integrated Urban Development, Kathmandu; and Janathakshan, Colombo) that have been active in the local implementation of MSWM as well as in regional and international partnerships and networks.

The project will create opportunities for students, junior and senior researchers from Sri Lanka, Nepal, India and Switzerland and thus contribute to capacity building. In each of the three countries, the respective academic and NGO partner will work together closely. The academic partners will supervise and carry out the major research activities; i.e., the exploratory research (senior researcher with university students), the quantitative household survey (with university students and with community members where possible); the waste diary (with college students where possible and with community members); the qualitative studies of waste generators, public spaces and the informal sector (with university students); and the ethnography of the state (senior researchers). The NGO partner in each country will organize three annual country-level stakeholder workshops, one project meeting each and the exchange visits of municipal officers and/or other stakeholders (champions). They will contact municipal offices, elected representatives and civil society leaders in the research localities as soon as the project starts. The collaboration between the country teams will be enabled through the exchange of data and reports and three project meetings, one in each country, as well as through the overall coordination by the Swiss partner. Janathakshan will furthermore set up regional social media platforms and produce a short documentary (YouTube clip).

Regarding dissemination to academic audiences, the project will favor joint publications, but single- or double-authored publications in discipline-based journals will not be excluded if the opportunity should arise. Publications will discuss experience of individual cities and comparative aspects; a synthesis of the overall research findings is planned from which practitioner-relevant content will be developed and translated in the vernacular language. Research findings will furthermore find their way into teaching curriculums.

As for the transdisciplinary aspect of the project, the communication strategy includes regular personal contacts with local stakeholders and three country-level workshops. In the inception workshops, for instance, stakeholders will be informed about the research plan and given an opportunity to revise it based on their perceptions and priorities. In the mid-term workshops, first findings will be discussed and triangulated with the stakeholders. In the final round of workshops, the different examined SWM governance systems and initiatives will be discussed. This event will also include the exploration of the potential and the feasibility of MSWM systems with more circular and livelihoods-oriented waste value chains and more decentralized/horizontal accountability structures. It should be noted that these stakeholder workshops do not just represent dissemination events but are part and parcel of the policy-oriented research strategy.

Regular communication with local and regional stakeholders will furthermore be ensured through the use of social media (Facebook, Twitter) and a project website, not just at the level of individual cities or countries but also across the region. Policy briefs and synthesis

documents per country will provide crisp, but contextualized information relevant to governance actors. For the purpose of scaling up, the project will engage actively with national, regional and international associations.

The strategy of application starts with the household-level waste diaries aiming to lead to more conscious waste practices. This pilot project will produce protocols on how to use waste diaries as an awareness-raising tool to be implemented in other South Asian cities. Furthermore, the strategy of application includes the exchange visits across national boundaries between municipal officials (“champions” selected based on their commitment) that aim to facilitate horizontal learning.

The project also envisages keeping video-logs to document major activities during the project phase. These logs can form the basis of video protocols that can be used for training purposes by local authorities and NGOs, as well as for a documentary (with English subtitles) for scaling-up activities. Furthermore written protocols will be produced in the relevant vernacular languages and in English. These will present different examined MSWM systems in view of their political and sociocultural acceptability. Other protocols will describe our analyses of how particular cities succeeded in designing and implementing more circular and livelihoods-oriented waste value chains and more horizontal, decentralized and participatory accountability structures in their MSWM systems. The mentioned protocols will be diffused via the social media platforms and the abovementioned national, regional and international networks.

Lay summary

Urbanization, economic development and growing consumerism in many parts of the Global South lead to a rapidly increasing production of household solid waste. In many developing cities, garbage collection remains incomplete, open dumping continues, and recycling and processing facilities are deficient. This situation leads to a wide range of local environmental problems (air pollution, soil and water contamination, etc.) that are closely linked to drinking water quality, sanitation and human health affecting mostly the urban poor. Furthermore, inappropriate solid waste management practices are also an important contributor to greenhouse gas emissions and thus also represent a global development issue.

The South Asian region, home to nearly one quarter of the world’s population, is witnessing the highest regional waste growth rate in the world, with municipal solid waste production expected to nearly triple between 2010 and 2025. The common response to this challenge is based on approaches that give emphasis to engineering and modern management. Such technical-institutional systems – in many cases centralized ones that may have proved successful in industrialized countries –are promoted by international donors, “sold” by transnational private firms and imitated by municipalities, often regardless of their technological appropriateness, institutional fit, local financial and technical capacities, as well as political and socio-cultural acceptability.

This project aims to examine alternative approaches to municipal solid waste management that are based on participation and collaborations between local stakeholders and on shortened, circular waste chains. In particular, we seek to analyze the political and sociocultural processes that have led to relatively successful alternatives and to assess their potential replication in different geographical contexts. To do this, recent governance initiatives that emerged endogenously in the wake of natural or human-induced crises in three South Asian cities are studied. In Thiruvananthapuram (Kerala, India), the municipality developed an innovative decentralized, community-based municipal solid waste management system after local protests in 2012 forced the closure of the centralized waste processing (composting) plant in the urban periphery. In Nepal, the earthquake and an Indian road blockade in 2015 hindered garbage trucks to move solid wastes out of the cities. In response, small private companies emerged to start door-to-door waste collection and neighborhood clubs took up awareness-raising activities in the urban periphery of Kathmandu. In the Colombo metropolitan area (Sri Lanka) the response to a lethal collapse of a municipal garbage dump was different: a special police unit, the Environment Police, increased its efforts to enforce the preexisting non-littering laws and to oblige people to use sorting waste bins in public spaces and waste segregation at source in their homes.

The research is carried out by an international and interdisciplinary team drawing upon the disciplines of geography, sociology, political science, development studies and engineering. It will contribute to a better understanding of the political and sociocultural processes that facilitate the emergence of innovative, politically feasible and socio-culturally appropriate initiatives in municipal solid waste management. In collaboration with local NGOs, emphasis is put on mutual learning through horizontal South-South partnerships between local authorities, civil society actors and researchers across South Asia.

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References

- Acuto M (2014) Everyday international relations: garbage, grand designs, and mundane matters. *International Political Sociology* 8 (4): 345-362. <https://doi.org/10.1111/ips.12067>
- Ahmed SA, Ali M (2004) Partnerships for solid waste management in developing countries: linking theories to realities. *Habitat International* 28 (3): 467-479. [https://doi.org/10.1016/s0197-3975\(03\)00044-4](https://doi.org/10.1016/s0197-3975(03)00044-4)
- Allen A, Lampis A, Swilling M (2015) *Untamed urbanism*. Routledge, Oxon.
- Ambat B (2000) A feasibility study on energy generation from solid waste: a case study of Thiruvananthapuram city. Centre for Environment and Development, Thiruvananthapuram.
- Ambat B (2003) Study of the attitude and perception of community towards solid waste management: a case study of Thiruvananthapuram city. Centre for Environment and Development, Thiruvananthapuram.
- Ambat B (2007) Quantification and characterization of solid wastes in Thiruvananthapuram city. Centre for Environment and Development, Thiruvananthapuram.
- Anonymous (2017) Errant garbage dumpers to be arrested in Colombo. *Daily Mirror - Sri Lanka* URL: <http://www.dailymirror.lk/article/Errant-garbage-dumpers-to-be-arrested-in-Colombo-130970.html>
- Asian Development Bank (2013) *Solid waste management in Nepal: current status and policy recommendations*. Asian Development Bank, Manila.
- Asian Regional Research Program on Environmental Technology (2006) *Municipal solid waste management in Asia*. Asian Development Bank, Manila.
- Baabereyir A, Jewitt S, O'Hara S (2012) Dumping on the poor: The ecological distribution of Accra's solid-waste burden. *Environment and Planning A* 44 (2): 297-314. <https://doi.org/10.1068/a44202>
- Bakker K (2003) A political ecology of water privatization. *Studies in Political Economy* 70 (1): 35-58. <https://doi.org/10.1080/07078552.2003.11827129>
- Bandara NG, Hettiaratchi JPA (2010) Environmental impacts with waste disposal practices in a suburban municipality in Sri Lanka. *International Journal of Environment and Waste Management* 6 (1/2): 107-107. <https://doi.org/10.1504/ijewm.2010.033987>
- Basnayake BFA, Visvanathan C (2013) *Solid Waste Management in Sri Lanka. Municipal Solid Waste Management in Asia and the Pacific Islands* 299-316. https://doi.org/10.1007/978-981-4451-73-4_15
- Beall J (2006) Dealing with dirt and the disorder of development: Managing rubbish in urban Pakistan. *Oxford Development Studies* 34 (1): 81-97. <https://doi.org/10.1080/13600810500496087>
- Bhattarai RC (2003) Household behavior on solid waste management: A case of Kathmandu Metropolitan City. *Economic Journal of Development Issues* 4 (1): 79-93.

- Bjerkli CL (2013) Governance on the ground: A study of solid waste management in Addis Ababa, Ethiopia. *International Journal of Urban and Regional Research* 37 (4): 1273-1287. <https://doi.org/10.1111/j.1468-2427.2013.01214.x>
- Campos MJZ, Zapata P (2014) The travel of global ideas of waste management. The case of Managua and its informal settlements. *Habitat International* 41: 41-49. <https://doi.org/10.1016/j.habitatint.2013.07.003>
- Chaturvedi A, Vijayalakshmi K, Saksham N (2015) Scenarios of waste and resource management: for cities in India and elsewhere. *IDS Evidence Report*.
- Cialdini R, Reno R, Kallgren C (1990) A focus theory of normative conduct: Recycling the concept of norms to reduce littering in public places. *Journal of Personality and Social Psychology* 58 (6): 1015-1026. <https://doi.org/10.1037//0022-3514.58.6.1015>
- Cointreau S (2001) Declaration of principles for sustainable and integrated solid waste management. <http://siteresources.worldbank.org/INTUSWM/Resources/siswm.pdf>. Accessed on: 2018-10-19.
- Colon M, Fawcett B (2006) Community-based household waste management: Lessons learnt from EXNORA's 'zero waste management' scheme in two South Indian cities. *Habitat International* 30 (4): 916-931. <https://doi.org/10.1016/j.habitatint.2005.04.006>
- Corbridge S, Williams G, Srivastava M, Véron R (2005) Seeing the State? Governance and Governmentality in India. Cambridge University Press <https://doi.org/10.1017/CBO9780511492211>
- Cornea N, Véron R, Zimmer A (2016) Clean city politics: An urban political ecology of solid waste in West Bengal, India. *Environment and Planning A* 49 (4): 728-744. <https://doi.org/10.1177/0308518x16682028>
- Cornea NL, Véron R, Zimmer A (2017) Everyday governance and urban environments: Towards a more interdisciplinary urban political ecology. *Geography Compass* 11 (4): e12310-e12310. <https://doi.org/10.1111/gec3.12310>
- Damodaran VK, Geena P, Joseph VT, Babu Ambat (2010) Review of strategy, framework and technological options for municipal solid waste management. Kerala Environment Congress.
- Dangi M, Pretz C, Urynowicz M, Gerow K, Reddy JM (2011) Municipal solid waste generation in Kathmandu, Nepal. *Journal of Environmental Management* 92 (1): 240-249. <https://doi.org/10.1016/j.jenvman.2010.09.005>
- Darwish S (2018) Balad el-Zibl  (Country of Rubbish): Moral geographies of waste in post-revolutionary Tunisia. *Anthropological Forum* 28 (1): 61-73. <https://doi.org/10.1080/00664677.2018.1427045>
- Decker E, Elliott S, Smith F, Blake D, Rowland FS (2000) Energy and material flow through the urban ecosystem. *Annual Review of Energy and the Environment* 25 (1): 685-740. <https://doi.org/10.1146/annurev.energy.25.1.685>
- Demaria F, Schindler S (2015) Contesting urban metabolism: Struggles over waste-to-energy in Delhi, India. *Antipode* 48 (2): 293-313. <https://doi.org/10.1111/anti.12191>
- Desa A, Kadir NBA, Yusooif F (2011) A Study on the knowledge, attitudes, awareness status and behaviour concerning solid waste management. *Procedia - Social and Behavioral Sciences* 18: 643-648. <https://doi.org/10.1016/j.sbspro.2011.05.095>
- Douglas M (1966) *Purity and danger: an analysis of the concepts of pollution and taboo*. Routledge, London.

- Fahmi WS (2005) The impact of privatization of solid waste management on the Zabaleen garbage collectors of Cairo. *Environment and Urbanization* 17 (2): 155-170. <https://doi.org/10.1177/095624780501700212>
- Fredericks R (2018) *Garbage Citizenship: Vital Infrastructures of Labor in Dakar, Senegal*. Duke University Press <https://doi.org/10.1215/9781478002505>
- Gasparatos A (2017) *Urban metabolism. Defining the urban: interdisciplinary and professional perspectives*. [ISBN 978-1-4724-4952-8].
- Gentil E, Damgaard A, Hauschild M, Finnveden G, Eriksson O, Thorneloe S, Kaplan PO, Barlaz M, Muller O, Matsui Y, Li R, Christensen T (2010) Models for waste life cycle assessment: Review of technical assumptions. *Waste Management* 30 (12): 2636-2648. <https://doi.org/10.1016/j.wasman.2010.06.004>
- Gidwani V (2015) The work of waste: inside India's infra-economy. *Transactions of the Institute of British Geographers* 40 (4): 575-595. <https://doi.org/10.1111/tran.12094>
- Gill K (2009) *Of Poverty and Plastic: Scavenging and Scrap Trading Entrepreneurs in India's Urban Informal Economy*. Oxford University Press <https://doi.org/10.1093/acprof:oso/9780198060864.001.0001>
- Graham S, Marvin S (2002) *Splintering urbanism: networked infrastructures, technological mobilities and the urban condition*. Routledge, London and New York. <https://doi.org/10.4324/9780203452202>
- Gunawardana EW, Basnayake BA, Shimada S, Iwata T (2009) Influence of biological pre-treatment of municipal solid waste on landfill behaviour in Sri Lanka. *Waste Management & Research* 27 (5): 456-462. <https://doi.org/10.1177/0734242x08095565>
- Gutberlet J (2008) Empowering collective recycling initiatives: Video documentation and action research with a recycling co-op in Brazil. *Resources, Conservation and Recycling* 52 (4): 659-670. <https://doi.org/10.1016/j.resconrec.2007.08.006>
- Gutberlet J (2010) Waste, poverty and recycling. *Waste Management* 30 (2): 171-173. <https://doi.org/10.1016/j.wasman.2009.11.006>
- Hartmann C (2012) Uneven urban spaces: Accessing trash in Managua, Nicaragua. *Journal of Latin American Geography* 11 (1): 143-163. <https://doi.org/10.1353/lag.2012.0003>
- Heynen N, Kaika M, Swyngedouw E (Eds) (2006) *In the Nature of Cities: Urban Political Ecology and the Politics of Urban Metabolism*. Taylor & Francis, Abingdon.
- Hoornweg D, Bhada-Tata P (2012) *What a waste: a global review of solid waste management*. The World Bank, Washington DC.
- Isaac T, Gopakumar M (2014) *Marunna Manasukal Maalinyamakalunna Theruvukal*. [Decentralized waste management in Alappuzha]. Chintha Publishers, Thiruvananthapuram. [In Malayalam].
- Jayasinghe R, Mushtaq U, Smythe TA, Baillie C (2013) The garbage crisis: A global challenge for engineers. *Synthesis Lectures on Engineers, Technology and Society* 7 (1): 1-155. <https://doi.org/10.2200/s00453ed1v01y201301ets018>
- Jewitt S (2011) Geographies of shit: Spatial and temporal variations in attitudes towards human waste. *Progress in Human Geography* 35 (5): 608-626. <https://doi.org/10.1177/0309132510394704>
- Joly M (2018) *Solid waste management, gender and class: the case of decentralized composting waste governance in Thiruvananthapuram*. University of Lausanne, Lausanne.

- Kaika M (2003) Constructing scarcity and sensationalising water politics: 170 days that shook Athens. *Antipode* 35 (5): 919-954. <https://doi.org/10.1111/j.1467-8330.2003.00365.x>
- Kingdon J, Thurber J (1984) *Agendas, alternatives, and public policies*. Little, Brown Boston
- Kumar S, Gaikwad SA, Shekdar AV, Kshirsagar PS, Singh RN (2004) Estimation method for national methane emission from solid waste landfills. *Atmospheric environment* 38 (21): 3481-3487. <https://doi.org/10.1016/j.atmosenv.2004.02.057>
- Lawhon M, Ernstson H, Silver J (2013) Provincializing urban political ecology: Towards a situated UPE through African urbanism. *Antipode* 46 (2): 497-516. <https://doi.org/10.1111/anti.12051>
- Lienert J, Schnetzer F, Ingold K (2013) Stakeholder analysis combined with social network analysis provides fine-grained insights into water infrastructure planning processes. *Journal of Environmental Management* 125: 134-148. <https://doi.org/10.1016/j.jenvman.2013.03.052>
- Loftus A (2012) *Everyday environmentalism: creating an urban political ecology*. University of Minnesota Press, Minneapolis and London. <https://doi.org/10.5749/minnesota/9780816665716.001.0001>
- Lundie S, Peters G (2005) Life cycle assessment of food waste management options. *Journal of Cleaner Production* 13 (3): 275-286. <https://doi.org/10.1016/j.jclepro.2004.02.020>
- Marshall R, Farahbakhsh K (2013) Systems approaches to integrated solid waste management in developing countries. *Waste Management* 33 (4): 988-1003. <https://doi.org/10.1016/j.wasman.2012.12.023>
- Marxsen C (2001) Potential world garbage and waste carbon sequestration. *Environmental Science & Policy* 4 (6): 293-300. [https://doi.org/10.1016/s1462-9011\(01\)00035-1](https://doi.org/10.1016/s1462-9011(01)00035-1)
- Mawdsley E (2004) India's middle classes and the environment. *Development and Change* 35 (1): 79-103. <https://doi.org/10.1111/j.1467-7660.2004.00343.x>
- Mawdsley E (2009) "Environmentality" in the Neoliberal City: Attitudes, Governance and Social Justice. In: Meier L, Lange H (Eds) *The New Middle Classes: Globalizing Lifestyles, Consumerism and Environmental Concerns*. Springer, Dordrecht, 237-251 pp. https://doi.org/10.1007/978-1-4020-9938-0_13
- Menikpura SNM, Gheewala S, Bonnet S (2012) Sustainability assessment of municipal solid waste management in Sri Lanka: problems and prospects. *Journal of Material Cycles and Waste Management* 14 (3): 181-192. <https://doi.org/10.1007/s10163-012-0055-z>
- Millington N, Lawhon M (2018) Geographies of waste: Conceptual vectors from the Global South. *Progress in Human Geography* <https://doi.org/10.1177/0309132518799911>
- Miraftab F (2004) Neoliberalism and casualization of public sector services: the case of waste collection services in Cape Town, South Africa. *International Journal of Urban and Regional Research* 28 (4): 874-892. <https://doi.org/10.1111/j.0309-1317.2004.00557.x>
- Mitchell C (2008) Altered landscapes, altered livelihoods: The shifting experience of informal waste collecting during Hanoi's urban transition. *Geoforum* 39 (6): 2019-2029. <https://doi.org/10.1016/j.geoforum.2008.07.006>

- Moore S (2008) The Politics of Garbage in Oaxaca, Mexico. *Society & Natural Resources* 21 (7): 597-610. <https://doi.org/10.1080/08941920701759551>
- Moore S (2009) The Excess of Modernity: Garbage Politics in Oaxaca, Mexico. *The Professional Geographer* 61 (4): 426-437. <https://doi.org/10.1080/00330120903143375>
- Moore S (2012) Garbage matters. *Progress in Human Geography* 36 (6): 780-799. <https://doi.org/10.1177/0309132512437077>
- Nading A, Fisher J (2018) Zopilotes, Alacranes, y Hormigas (vultures, scorpions, and ants): Animal metaphors as organizational politics in a nicaraguan garbage crisis. *Antipode* <https://doi.org/10.1111/anti.12376>
- Narayanan NC (2008) State, natural resource conflicts and challenges to governance: where do we go from here? Academic Foundation, New Delhi.
- Narayanan NC, Parasuraman S, Ariyabandhu R (Eds) (2012) *Water Governance and Civil Society Responses in South Asia: Paradigm Shifts and Civil Society Responses*. Routledge, New Delhi.
- O'Brien M (1999) Rubbish values: Reflections on the political economy of waste. *Science as Culture* 8 (3): 269-295. <https://doi.org/10.1080/09505439909526548>
- Parizeau K (2015a) Re-representing the city: Waste and public space in Buenos Aires, Argentina in the late 2000s. *Environment and Planning A* 47 (2): 284-299. <https://doi.org/10.1068/a130094p>
- Parizeau K (2015b) Urban political ecologies of informal recyclers' health in Buenos Aires, Argentina. *Health & Place* 33: 67-74. <https://doi.org/10.1016/j.healthplace.2015.02.007>
- Pelling M (2012) *The Vulnerability of Cities : Natural Disasters and Social Resilience*. Routledge
- Pokhrel D, Viraraghavan T (2005) Municipal solid waste management in Nepal: practices and challenges. *Waste Management* 25 (5): 555-562. <https://doi.org/10.1016/j.wasman.2005.01.020>
- Ramachandra TV, Bachamanda S (2007) Environmental audit of municipal solid waste management. *International Journal of Environmental Technology and Management* 7 (3/4): 369-369. <https://doi.org/10.1504/ijetm.2007.015152>
- Rattu P, Véron R (2015) How to govern the urban hydrosocial cycle: archaeo-genealogy of hydromentalities in the Swiss urban water sector between 1850 and 1950. *Geographica Helvetica* 70 (1): 33-44. <https://doi.org/10.5194/gh-70-33-2015>
- Rattu P, Véron R (2016) Towards a Foucauldian Urban Political Ecology of water: Rethinking the hydro-social cycle and scholars' critical engagement. *Foucault Studies* 138-138. <https://doi.org/10.22439/fs.v0i0.5021>
- Rengarajan N (2013) *Municipal solid waste management in India: Finding Sustainable Pathways For The City Of Bangalore/ MSc Thesis*. Arizona State University
- Samson M (2015) *Forging a new conceptualization of the public in waste management. Women in Informal Employment: Globalizing and Organizing*
- Shekdar A (2009) Sustainable solid waste management: An integrated approach for Asian countries. *Waste Management* 29 (4): 1438-1448. <https://doi.org/10.1016/j.wasman.2008.08.025>
- Shillington L (2012) Urban political ecology in the global south: everyday environmental struggles of home in Managua, Nicaragua. *Urban theory beyond the West. A world of cities*.

- Smythe TA (2011) A preliminary socio-economic, technical and environmental feasibility study for Waste for Life in the Western Province of Sri Lanka. Thesis. University of Western Australia
- Sundaesan J (2017) Urban planning in vernacular governance: Land use planning and violations in Bangalore, India. *Progress in Planning* <https://doi.org/10.1016/j.progress.2017.10.001>
- Swearer D (2006) An assessment of Buddhist eco-philosophy. *Harvard Theological Review* 99 (02). <https://doi.org/10.1017/s0017816006001179>
- Swyngedouw E (1996) The city as a hybrid: On nature, society and cyborg urbanization. *Capitalism Nature Socialism* 7 (2): 65-80. <https://doi.org/10.1080/10455759609358679>
- Swyngedouw E (1997) Power, Nature, and the City. The Conquest of Water and the Political Ecology of Urbanization in Guayaquil, Ecuador: 1880–1990. *Environment and Planning A* 29 (2): 311-332. <https://doi.org/10.1068/a290311>
- Swyngedouw E, Heynen NC (2003) Urban Political Ecology, Justice and the Politics of Scale. *Antipode* 35 (5): 898-918. <https://doi.org/10.1111/j.1467-8330.2003.00364.x>
- Tchobanoglous G, Theisen H, Vigil S, Alaniz V (1993) *Integrated Solid Waste Management: Engineering Principles and Management Issues*. McGraw-Hill New York
- Thomas-Hope E (1998) *Solid Waste Management: Critical Issues for Developing Countries*. Canoe Press, University of the West Indies
- Troschinetz A, Mihelcic J (2009) Sustainable recycling of municipal solid waste in developing countries. *Waste Management* 29 (2): 915-923. <https://doi.org/10.1016/j.wasman.2008.04.016>
- Truelove Y (2011) (Re-)Conceptualizing water inequality in Delhi, India through a feminist political ecology framework. *Geoforum* 42 (2): 143-152. <https://doi.org/10.1016/j.geoforum.2011.01.004>
- Truelove Y (2016) Incongruent waterworlds: Situating the everyday practices and power of water in Delhi. *South Asia Multidisciplinary Academic Journal* <https://doi.org/10.4000/samaj.4164>
- Turner BL, Kasperson R, Meyer W, Dow K, Golding D, Kasperson J, Mitchell R, Ratick S (1990) Two types of global environmental change. *Global Environmental Change* 1 (1): 14-22. [https://doi.org/10.1016/0959-3780\(90\)90004-s](https://doi.org/10.1016/0959-3780(90)90004-s)
- UNEP (2009) *Developing Integrated Solid Waste Management Plan Training Manual*. UNEP, Osaka/Shiga.
- UN-Habitat (2010) *Solid Waste Management in the World's Cities: Water and Sanitation in the World's Cities 2010*. Routledge <https://doi.org/10.4324/9781849774871>
- United Nations (2018) *SDGsö sustainable Development Knowledge Platform*. <https://sustainabledevelopment.un.org/sdgs>. Accessed on: 2018-10-19.
- Véron R (2006) Remaking Urban Environments: The Political Ecology of Air Pollution in Delhi. *Environment and Planning A* 38 (11): 2093-2109. <https://doi.org/10.1068/a37449>
- Véron R, Williams G, Corbridge S, Srivastava M (2006) Decentralized Corruption or Corrupt Decentralization? Community Monitoring of Poverty-Alleviation Schemes in Eastern India. *World Development* 34 (11): 1922-1941. <https://doi.org/10.1016/j.worlddev.2005.11.024>
- Vishwakarma A, Kulshreshtha M, Kulshreshtha M (2012) Efficiency evaluation of municipal solid waste management utilities in the urban cities of the state of Madhya Pradesh, India, using stochastic frontier analysis. *Benchmarking: An International Journal* 19 (3): 340-357. <https://doi.org/10.1108/14635771211242996>

- Wilson D, Velis C, Rodic L (2013) Integrated sustainable waste management in developing countries. *Proceedings of the Institution of Civil Engineers - Waste and Resource Management* 166 (2): 52-68. <https://doi.org/10.1680/warm.12.00005>
- Yadav P, Samadder SR (2014) Life cycle assessment of solid waste management options: A Review. *Recent Research in Science and Technology* 6 (1): 113-116.
- Yates J, Gutberlet J (2011) Enhancing Livelihoods and the Urban Environment: The Local Political Framework for Integrated Organic Waste Management in Diadema, Brazil. *Journal of Development Studies* 47 (4): 639-656. <https://doi.org/10.1080/00220388.2010.506914>
- Zhu D, Asnani PU, Zurbrugg C, Anapolsky S, Mani S (2007) Improving Municipal Solid Waste Management in India. *The World Bank* <https://doi.org/10.1596/978-0-8213-7361-3>
- Zurbrügg C, Drescher S, Patel A, Sharatchandra HC (2004) Decentralised composting of urban waste – an overview of community and private initiatives in Indian cities. *Waste Management* 24 (7): 655-662. <https://doi.org/10.1016/j.wasman.2004.01.003>
- Zurbrügg C, Drescher S, Rytz I, Sinha AHM, Enayetullah I (2005) Decentralised composting in Bangladesh, a win-win situation for all stakeholders. *Resources, Conservation and Recycling* 43 (3): 281-292. <https://doi.org/10.1016/j.resconrec.2004.06.005>
- Zurbrügg C, Gfrerer M, Ashadi H, Brenner W, Küper D (2012) Determinants of sustainability in solid waste management – The Gianyar Waste Recovery Project in Indonesia. *Waste Management* 32 (11): 2126-2133. <https://doi.org/10.1016/j.wasman.2012.01.011>

Endnotes

- *1 Municipal solid waste is commonly defined as garbage (food wastes, plastics, paper, glass, metals, construction debris, etc.) thrown away by households, restaurants, shops, offices, streets and public spaces. The definition excludes excreta, biomedical, industrial and e-waste, although these will sometimes end up in the municipal waste management stream and cause additional environmental and health concerns. Municipal Solid Waste Management (MSWM) refers to the collection, transportation, treatment and disposal systems of waste [2].
- *2 At times a fourth 'R' for recovery (deriving products from waste such as energy or soil) is added.
- *3 This method will not be applicable in Sri Lanka due to particular research ethics protocols for working with youth.