



Managing plastic waste in East Africa: Niche innovations in plastic production and solid waste



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ABSTRACT

This paper assesses the uptake of environmental innovation practices to cope with plastic waste in Kenyan urban centres at the interface of solid waste management and plastic production systems. The Multi Level Perspective on Technological Transitions is used to evaluate 7 innovation pathways of plastic waste prevention, reuse or recycling. An assessment is made as to whether the innovations lead to changes in the regimes of waste management and plastic production and eventually an integrated regime for plastic production and reuse. The study comprises of a review of policy documents and statistics, site visits and in-depth interviews with main actors involved in plastic waste related innovation. The comparative analysis of social network building, actor expectations and learning processes in the 7 innovation routes reveals that Kenya is still far from having a well-aligned plastic production-cum-waste regime that enables plastic waste prevention, recycling and handling practices. Innovations by yard shop owners and home grown industries contribute to an aligned plastic waste recycling regime, where PET exporters, bio-degradable plastic sellers and CBO collectors fail to do so. All innovation actors face a lack of governmental recognition and guidelines to close the loop of plastic production and waste handling.

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1. Introduction

The percentage of plastic waste in domestic solid waste is closely related to levels of economic development. Generally, in terms of weight, plastic waste is the third major component of municipal waste in East African cities after organic waste and paper waste (UNEP, 2009). With rapid urbanization and economic development, and the associated growth of industry and services, plastic waste levels in East Africa are approaching 10% wet weight of the total solid waste flows in major urban centres (JICA, 2010; Oberlin, 2011; Oyoo, Leemans, & Mol, 2011). Much of the plastic waste in East Africa is littered on public places, dumped at illegal sites and blocks drainage and sewer systems. As such plastic waste affects public health, water and sewerage services and tourism, among others. But plastic waste also represents a valuable resource, which can be profitably ploughed back into the economy.

While many cities in developed countries have instituted effective approaches to waste management through separation, re-

use/recycling, and prevention, the general situation for cities in East Africa is different (Oyoo et al., 2011; Scheinberg, Spies, Simpson, & Mol, 2011; UNCHS, 2010). The delivery of public services has for a long time been failing in East Africa, where access to adequate waste collection and sanitation is still very low (see also Crook & Aye, 2006; Katusimeh, Mol, & Burger, 2012; Oosterveer, 2009; Oyoo et al., 2011; Van Dijk, 2006). For close to two decades, the solid waste management systems of East African major urban centres have been suffering from a lack of adequate human, financial and technological resources, a poor organization of operational processes, and a typical relation between central and local government (Karanja, 2005). Local authorities have little autonomy in financial and administrative decision-making, including those responding to waste challenges (UNCHS, 1998). The poor waste management situation manifests in the very low waste collection levels (JICA, 2010; Rotich, Zhao, & Dong, 2006) and geographical restrictions of waste collection to central business districts and high income neighbourhoods. The urban poor, usually residing in informal settlements are abstained from access to solid waste collection and disposal and face the health and environmental consequences of that (Katusimeh et al., 2012; Tukahirwa, Mol, & Oosterveer, 2013).

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In studying plastic waste problems in East Africa – and in particular in Kenya, our research area – most authors have focused on post-consumer aspects of solid waste collection and disposal, putting municipal authorities central as the core institution that can provide viable sustainable waste management systems (e.g. Bahri, 2005; Karanja, 2005; Kassim & Ali, 2005; Mugambi, 2001; Oyoo et al., 2011; Rotich et al., 2006). But collecting and adding value to plastic waste has been practiced in Kenya by private actors since the 1980s, when individual waste pickers, yard shop owners and small-scale traders started to sell unprocessed plastic waste directly to plastic producers who used these materials to manufacture new plastic products. Since the 1990s and partly driven by a general lack of employment and high poverty levels (Republic of Kenya, 2010), community based organizations (CBOs) involved in waste collection and disposal started to venture into recovery of plastic waste. They often worked together with Savings and Credit Cooperative Societies (SACCOs), organizations where individuals and CBOs place their savings and receive advantageous rates for loans, as well as other social benefits. Several authors, from different perspectives, have stressed the important contribution of these (in)formal CBOs, CBO-SACCOs, yard shop owners and small-scale traders in effective waste management (e.g. Allison, Harris, Hofny-Collins, & Stevens, 1998; Katusiimeh et al., 2013; Liyala, 2011; Scheinberg & Mol, 2010; Tukahirwa, Mol, & Oosterveer, 2011; Tukahirwa et al., 2013; UNDP, 2006; WASTE, 2004).

Parallel to plastic waste management activities of (in)formal private actors, plastic producers and other chain actors have explored the use of plastic waste as a raw material in Kenyan plastic production (KNPC, 2006; Mugambi, 2001; Njeru, 2006). An extensive body of literature underscores the benefits of promoting plastic waste recovery and recycling as a viable strategy to sustainable plastic waste management (e.g. Furedy, 1997; Karanja, Ikiara, & Davies, 2004; Scheinberg et al., 2011). Plastic production started to take off in Kenya from the early 1990s, although Kenya still imports all the polymers (polyethylene PE and polypropylene PP especially, and smaller quantities of polystyrene PS, polyethylene-terephthalate PET, polyurethane PU and polyvinyl-chloride PVC) as it has no petro-chemical polymer production units. Around 2010 the use of post-consumer waste as raw material for plastic production has increased to 11% of total raw material (Oyake-Ombis, 2012). Easy access to plastic production technology and liberalization of trade at regional and global levels enabled the use of plastic waste as a raw material in production processes. In Kenya, private industrial actors largely rely on informal actors to provide them with plastic waste as raw material. Hence, better collaboration between the solid waste management system and plastic production system might further increase the amount of plastic waste removed from the environment and turned into profitable raw material.

This paper assesses the uptake/institutionalization of novel practices to cope with plastic waste (labelled environmental innovations) at the interface of the solid waste management and the plastic production system. An environmental innovation is here defined as a practice in which actors add value to plastic waste and close the material cycle. Such plastic waste innovations can relate to better management/recovery of plastic waste to reduce littering, recycling/re-use of plastic waste, and prevention of plastic waste. The Multi Level Perspective on Transitions (MLP) (Geels, 2002) is used to put the envisioned regime change into its multi-layered context. Strategic Niche Management (Schot & Geels, 2008) is utilised as an analytical frame to assess whether and to what extent the innovations lead to changes in waste management and plastic production regimes and – eventually – into an integrated regime for plastic production and reuse. The geographical focus is on the four major urban centres of Nairobi, Mombasa, Kisumu and Nakuru

where a variety of new practices have been experimented to cope with plastic waste. The next section outlines the applied theoretical frame, transition theory, followed by the research methodology. Subsequently, the success or failure of seven different niche innovations is analysed, also in terms of aligning the solid waste management and the plastic production systems. Finally conclusions are drawn.

2. Transition theory

Better management of plastic waste can be interpreted as a change or transition of conventional solid waste management and plastic production systems. Transition theory and especially the Multi Level Perspective on Transitions will be applied to study such changes in urban Kenya.

2.1. Multi-level perspective on transitions

The Multi Level Perspective on Transitions has been applied especially in developed societies to analyse long term developments and major changes in socio-technical systems, such as transport systems, energy systems, water systems and food systems. This perspective builds on insights from complex systems theory, innovation studies, theories on large technical systems, history of technology and long-wave theory in economics. It adopts the idea that different analytical levels need to be distinguished for analysing and explaining change in socio-technical systems. Three levels are discerned: niche innovations, socio-technical regimes, and socio-technical landscape (Geels, 2002; Rip & Kemp, 1998; see Fig. 1). System innovation and transformation come about as a result of the interplay between processes at the three levels: major changes materialize because processes at multiple levels link up, align and influence each other (Geels, 2005a, 2005b; Rip & Kemp, 1998). Radical innovations emerge in niches (the lowest level), which are often outside or at the fringe of an existing regime (the second level). At the niche level, there are no stable rules to support innovations and therefore it is up to the involved actors to come up with a configuration that can either compete with or replace the dominant regime. If and when actors succeed to innovate, small niche markets stabilize, which support and partly institutionalize the innovation and may even grow to change the dominant regime. Innovations may also remain stuck in these niches for a long time or completely fail to take-off altogether, when they face a mismatch with the existing regime and landscape (highest level) and have not enough strength to change the latter two. The last phase of a successful innovation journey is when there is a breakthrough within the existing (dominant) regime and an innovation is able to embed itself in society and create market linkages necessary to be able to compete with the existing regime (Geels & Schot, 2007). Fig. 1 provides an illustration of the process of niche development, regime breakthrough and system change.

The multi-level perspective holds that both internal niche dynamics and external regime and landscape developments are important in ensuring a breakthrough in the regime and diffusion of innovations. Hence, the MLP provides us a general framework to understand and explain (the absence of) radical changes within either the conventional solid waste management system or the plastic production system. The next sub-section provides the tools to analyse niche innovations and the actors who 'carry' these innovations.

2.2. Strategic niche management

Strategic Niche Management (SNM) is used within a multi-level perspective to study the development of niche innovations, crucial

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