Foreign aid in waste management: A case of Kathmandu, Nepal

Mohan B. Dangi^{*}, Erica Schoenberger, John J. Boland

Department of Geography and Environmental Engineering, The Johns Hopkins University, 3400 N. Charles Street, Baltimore, MD 21218, United States

Abstract:

Four decades of reorganization of waste management in Kathmandu, Nepal funded by foreign aid failed to provide adequate services and led to the return of riverbank waste disposal by 1994. To assess the results of foreign aid in waste management in Kathmandu from 1970 to 2010, the researchers utilized qualitative and field methods and examined three major international projects sponsored by the governments of Germany, India, and Japan. Results suggest that German aid was too technical, undermining municipal capacity and burdening the city with a second waste disposal institution while failing to sustain its own infrastructure. The Indian project lacked focus and follow up programs and encumbered a poor country with outdated equipment that did not meet the local needs. Japanese aid depended on wrong assumptions, stressing costly landfilling that employed heavy machinery and upgraded equipment inappropriate for local conditions. The study recommends that Nepal institute bottom-up and participatory style of waste management that identifies where the resources will come from, who will manage them, and how they will be sustained.

Keywords:

Municipal solid waste, Solid waste management, Foreign aid in waste management, Effectiveness of foreign aid in Kathmandu, Nepal

1. Introduction

In Nepal, only three municipalities have some sort of formal management of municipal solid waste (MSW). One of the three, Kathmandu has a semi-formal solid waste management (SWM). Kathmandu has 35 wards, each of which is responsible for cleaning and organizing the collection and disposal of wastes, done by 1047 *kuchikars* (sweepers). Traditionally, the *Safai Adda* (sanitary office) established in 1919 assigned urban sanitation duties to *kuchikars*, who mostly come from *Podey*, *Chyame*, and *Halahulu* castes. This practice institutionalized street sweeping, collecting garbage from quadrangles and palaces, and dumping the wastes into rivers or open places. Though the *Safai Adda* was renamed Municipality Office in 1931, the *kuchikars* and public continued to follow the historical cleaning system. In this setting citizens were also directly involved in maintaining cleanliness in their neighborhood and quadrangles.

In 1950, Kathmandu Valley established three municipalities as its core city centers: Kathmandu, Lalitpur, and Bhaktapur (Thapa, 1998), and with this change, SWM responsibility began to

transfer to these local authorities. Nevertheless, even as the local government assumed public solid waste disposal in the city, the deposition of solid wastes into the Bagmati and the Bishnumati rivers via municipal *kuchikars* continued. From that point, the public shunned participation in SWM.

In 1970, the Nepalese government commissioned a World Health Organization (WHO) expert to study SWM in Kathmandu (Flintoff, 1971) that was followed by German aid via SWM Project from 1978 to 1993. The SWM Project developed a national organization, the Solid Waste Management and Resource Mobilization Center (SWMRMC),¹ to carry out SWM in Kathmandu Valley municipalities, built a permanent facility—the Gokarna Landfill Site (GLS) situated 16 km northeast of Kathmandu, and constructed a compost plant in Teku located at the southern edge of Kathmandu city near the bank of the Bagmati River. See Fig. 1. The compost plant with a capacity of 15 metric tons per day of compost production from food and yard wastes was closed prematurely in 1990. The GLS that had been projected to accommodate comingled MSW from Kathmandu Valley municipalities for 200 years was shut down in 1993. These closures thus exacerbated the SWM problem in Kathmandu in early 1994.

The government then designated dump sites near the banks of

^{*} Corresponding author. Department of Geography and City & Regional Planning, California State University, Fresno, 2555 E. San Ramon Avenue, M/S SB69, Fresno, CA 93740, United States. E-mail addresses: mdangi@csufresno.edu, garbagetalk@gmail.com (M.B. Dangi).

¹ SWMRMC is now called Solid Waste Management Technical Support Center under the Ministry of Urban Development.

Fig. 1. Location of MSW facilities for Kathmandu city (Dangi, 2009). AD = Active dump, AL = Active landfill, CD = Closed dump, CL = Closed landfill, PL = Proposed landfill, PTS = Proposed transfer station, TS = Transfer station.

the Bagmati and Bishnumati rivers that served as the only disposal facilities for over ten years. At the same time, India provided a large consignment of equipment and a handful of countries contributed some indirect aid in the 1990s. As these aid packages proved unhelpful, the government secured assistance from Japan to develop a permanent landfill, Banchare Danda (hill) Landfill Site (BLS), 28 km from Kathmandu in Okharpauwa village in Nuwakot district (Fig. 1). A nearby temporary landfill, Sisdol Landfill Site (SLS), began operation in June 2005. The development of this region as a lasting landfill is contingent upon the government's ability to complete local development work. More on local development work can be found in Dangi (2009).

Despite the temporary landfill's operation, the MSW problem appears chronic in Kathmandu. The method of management is technology driven, which disregards a cradle-to-grave approach in SWM and consistently pursues landfilling even though 71% of waste (household) is organic (Dangi, Pretz, Urynowicz, Gerow, & Reddy, 2011). This has driven the unit management cost above

that of most developing countries, i.e. US\$2.71/capita/annum or 1.01% of Gross National Product (Dangi, 2009).

To examine the outcomes of foreign aid in SWM in Nepal mostly between 1970 and 2010, the researchers utilized qualitative and field methods and studied three major international projects in SWM provided by the governments of Germany, India, and Japan. The paper is organized into five sections. This includes introduction, methods, foreign aid in SWM, conclusions, and recommendations.

2. Methods

The field study conducted from June to August 2007 investigated 336 Kathmandu city households from four strata that were defined and modified after a pilot study. The details of the methods used in the pilot study, conducted from December 14 to 31, 2005, can be found in Dangi, Urynowicz, Gerow, and Thapa (2008) and Dangi, Cohen, Urynowicz, and Poudyal (2009). Field study results dealing with waste generation and characterization and methods

used are provided in Dangi et al. (2011). Similar methods were used in two other studies (Dangi, Urynowicz, & Belbase, 2013; Dangi, Fernandez, Bom, Belbase, & Kaphle, 2015). The 336 households selected come from 20 of the 35 Kathmandu city wards using three-stage cluster sampling techniques representing four socio-economic strata (Scheaffer, Mendenhall, & Ott, 2006). Using the pilot study as a basis, a total of 336 households were chosen for the field study. The description of the field study that is relevant to this manuscript is in the following subsections.

2.1. Household survey

A household interview survey was conducted to understand household solid waste information, the effectiveness of local policies and governance records, applicability of organizational functions and capacity, transparency and use of foreign aid in waste management, and demographic information. To lessen the effect of the rapidly changing political and physical environmental conditions in Nepal, it was important to complete the survey in a short duration. Therefore, the entire survey was accomplished in a ten-day period during July 5–15, 2007 by fifteen scientists, including the lead author that had completed human subjects research education. The information from the survey was triangulated with the findings of the interviews and details from reports and government publications.

2.2. Disposal site observation

Five focused visits took place: Gokarna landfill visit on July 13, 2007; Sisdol landfill and Banchare Danda proposed landfill visit in Okharpauwa on July 14, 2007; examination of corridors along Bagmati and Bishnumati rivers on July 20, 2007; visit to transfer station in Teku, Kathmandu city streets, and *chowks* in July 2007; and inspection of waste disposal points, waste containers, and dumps in different Kathmandu wards and *toles* during January and February 2008. (*Chowk* is a Nepalese word referring to common courtyard for houses that encircle it and a *tole* is defined as a cluster of houses in a neighborhood.) The first author observed the stretches of Bagmati and Bishnumati rivers from the headwaters down below the confluence point in the Sundarighat area located south of Kathmandu city. He also visited the transfer station in Teku and many of the waste disposal points inside Kathmandu in July 2007.

2.3. Interviews

The interviewer (first author) carefully studied the interviewees' respective organizations to gain a good understanding of the topics to be covered and to avoid any possible misunderstandings during the interviews. Because some interviewees would have been reluctant to discuss the weaknesses and inefficiencies of the institutions they represent, the mode of communication was nonjudgmental, with each question framed in the culture and language with which the respondents were accustomed. Because of the wide variety of organizations and groups the interviewees represented, it was difficult to pose the same questions to all of them, but certain interviewing standards were maintained during all interviews (Schoenberger, 1991). For example, only the researcher (first author) conducted the interviews; and the time limit, targeted goals, interviewing approach, and atmosphere of the interviews were carefully planned. These steps were particularly important when dealing with people from different backgrounds and levels of authority. So, the fundamental approach of the interview was to generate a 'collaborative dialogue' that encouraged participants to respond to the major research questions in a

non-threatening environment (Schoenberger, 1991).

A large part of the primary information was gathered from 38 structured individual interviews coming from five categories of people including *kuchikars* and *kavadi* (scrap) owners; non-governmental organization (NGO) representatives and private waste collectors; Kathmandu city officials; government managers, secretaries and ministers; and foreign aid officials (Table 1). The interviews were conducted using open-ended questions aimed at understanding institutional behavior, history, circumstances (Schoenberger, 1991), and applicability of foreign aid resources from the bottom up. The list of interviewees was developed to account for the frequent changes at the central and local levels in government and personnel that are responsible for SWM in Nepal. While the researcher interviewed the participating individuals, the conversations were recorded using a Sony Cassette-Corder (TCM-200DV) and typed simultaneously as a backup. All the recorded tapes were later analyzed and compared with the typed transcript.

2.4. Group interviews

The focus group interviews were held during site visits to Gokarna, Okharpauwa, and the corridors of Bagmati and Bishnumati rivers in July 2007. The researcher, with professors from Tribhuvan University and Kathmandu University, local experts, and selected student scientists, conducted these interviews. They

Table 1
List of individuals interviewed in July–August 2007.

Names/individuals	Affiliation/information
Anita	<i>Kuchikar</i> , Kathmandu City Ward 25
Sanu K. Chyame	<i>Kuchikar Naika</i> (Supervisor), Kathmandu City Ward 30
Ishwor M. Dangol	Former Ward Chairman, Kathmandu City Ward 15
Durga D. Dulal	Women Environment Committee, Kathmandu
Babu R. Gautam	Undersecretary, Ministry of Local Development
Deb P. Gurung	Minister, Ministry of Local Development
Gopal Joshi	Former Ward Chairman, Kathmandu City Ward 32
Nabindra R. Joshi	Former Deputy Mayor, Kathmandu City
Chitra B. Karki	ECL-Nepal 'NGO', Kathmandu
Debindra Khadka	Chairman, <i>Safai Nepal Samuha</i> (Clean Nepal Group)
Madhav Khadka	Vice Chairman, <i>Safai Nepal Samuha</i>
Jhlanath Khanal	Former Minister, Ministry of Information and Communication
Machchha Krishna	<i>Kuchikar</i> , Kathmandu City Ward 25
Prakash Kshetri	<i>Safai Nepal Samuha</i>
Krishna P. Lamsal	Program Officer, JICA Nepal Office
Bidur Mainali	General Secretary, Municipal Association of Nepal
Sano Maiya-(a)	<i>Kuchikar</i> , Kathmandu City Ward 25
Sano Maiya-(b)	<i>Kuchikar</i> , Kathmandu City Ward 25
Rajesh Manandhar	Program Associate, UN-HABITAT, Nepal
Rajendra Pandey	Former Minister, Ministry of Local Development
Ganesh Poday	<i>Kuchikar Naika</i> , Kathmandu City Ward 25
Rabindra K. Rai	Chief, Solid Waste Management Section, Kathmandu City
Ashok Shahi	General Manager, SWMRMC, Lalitpur
Surya M. Shakya	Former General Manager, SWMRMC, Lalitpur
Rabin M. Shrestha	Chief, Environment Management Department, Kathmandu City
Ram K. Shrestha	Secretary, Ministry of Local Development
Keshav Shapit	Former Mayor, Kathmandu City
Madhav Subedi	<i>Kuchikar</i> Supervisor, Kathmandu City Ward 27
Nirmala Subedi	Secretary, Kathmandu City Ward 10
Bishnu Thakali	Women Environment Preservation Committee, Lalitpur
Dinesh K. Thapaliya	Chief Executive Officer, Kathmandu City
Sajan Udas	Proprietor, <i>Kavadi</i> Collection, Kathmandu
Basudev Upreti	Kathmandu Solid Waste Management Systems
Tsumori Yusuke	Assistant Resident Representative, JICA Nepal Office
Name undisclosed	Informal Waste Collector-(a), Rani Pokhari, Kathmandu
Name undisclosed	Informal Waste Collector-(b), Rani Pokhari, Kathmandu
Name undisclosed	Scavenger-(a), Balkhu, Lalitpur
Name undisclosed	Scavenger-(b), Balkhu, Lalitpur

queried local residents, people near access roads to solid waste facilities, villagers, and passersby in groups of two or more people where a team of two field scientists asked questions about the information that would substantiate any environmental documents prepared for the corresponding landfills and post-closure activities undertaken. Several days were spent visiting waste disposal facilities in Kathmandu and communicating with collectors and local waste handlers to document waste management strategies at the base level and any challenges these workers face.

In addition to the field study, two more visits to landfill locations were conducted in the summers of 2010 and 2013 and an examination of transfer station in Teku took place in the summer of 2014. Likewise, Chief of Environment Department of Kathmandu city was consulted in April 2015 to learn current effort in SWM.

3. Foreign aid in SWM

The government first sought foreign support in SWM in Kathmandu Valley with its attempt to address the WHO recommendations from the early 1970s (Flintoff, 1971). These included house-to-house collection of waste via hand-carts; use of refuse trucks to collect wastes in wider streets; construction of a sanitary landfill at the riverbank; composting of organic wastes; and establishment of a separate department to run SWM at Kathmandu city (Tabasaran, 1976; Tuladhar, 1996). Kathmandu city didn't fully implement any of these suggestions and we could not determine why. So, the Nepalese government approached the Federal Republic of Germany and a study was commissioned in 1976 through the German Technical and Financial Aid Organization (GTZ). This study aimed to assess the *status quo* of SWM in the three major urban areas of Kathmandu Valley. The involvement of GTZ marked the beginning of formal aid for SWM in Kathmandu. The subsections below analyze the SWM aid provided by different countries.

3.1. German assistance

The German aid through SWM Project includes four phases. In Phase I (1978–1983), the SWM Project formed a Solid Waste Management Board under the Ministry of Works and Transport; entered into a bilateral agreement between the Government of Nepal and Germany for long-term SWM in Kathmandu Valley; identified a Nepalese manager to run the project; and started work in 16 wards of Kathmandu and Lalitpur municipalities. In Phase II (1983–1986), the SWM Project focused on public education and awareness; developed a proposal for tariff collection; enhanced collection efficiency of total waste generated in Kathmandu and Lalitpur by 33%; built a compost plant in Teku; and established GLS, which began operating in October, 1986.

The major achievement of Phase III (1987–1990) was commencement of Solid Waste (Management and Resource Mobilization) Act, 1987. This act institutionalized SWM Board by creating SWMRMC, an autonomous body currently under the Ministry of Local Development (MLD). This phase also included: the beginning of a tariff system; initiating modern SWM; instituting computerized accounting in management; and launching of abattoirs, public toilets, septic tanks, washing facilities for vegetables, and collection and disposal of hazardous and special wastes (SWMRMC, 2005; Tuladhar, 1996). The planned milestones for Phase IV (1990–1993) included expansion of education program; increased municipal role in street sweeping; institutional improvement in SWMRMC; and handover of SWM Project to Nepalese authorities.

The startup of GLS and the compost plant may have relieved Kathmandu city briefly. However, the difficulties in SWM escalated soon after the closure of the compost plant in August 1990 and then

the shutting down of GLS in 1993 to accommodate the complaints of residents of Gokarna. The closing of the compost plant appears to have been the result of odor related issues as well as ill-suited technology that did not emphasize source segregation of organic wastes, lacked frequent aeration and turning of compost piles, and failed to remove glass hazard found in the compost. The GLS closed as a result of environmental issues related to leachate runoff followed by strong public opposition.

In sum, the premature closure of GLS and the compost plant threatened the entire structure put in place by the SWM Project. In particular, it impelled the municipality to revert to riverbank disposal of MSW. In short, it was becoming increasingly clear that the project infrastructure was unsustainable. The political transformation of the 1990s delayed the earlier plan of GTZ to transfer the SWM Project to the Nepali side in July 1990. At the same time, the financial condition of SWMRMC was deteriorating, primarily because of hefty salaries and retirement costs to its employees. Largely this high salary gap between the employees of SWMRMC and municipalities caused the municipalities to refuse to take over the SWMRMC or fund its collection costs as planned. Thus, the compounding problems in the end prompted GTZ to stop its support in 1993.

Before the SWM Project and especially during the early phases of the project, many experts believed that Kathmandu city did not have a significant problem with garbage strewn in the streets (Thapa, 1998; Tuladhar, 1996), but by the later phases problems began to surface. In recent years the impact of sewage, waste, and illegal settlements into surface waters of Kathmandu has also been documented by Rademacher (2007, 2008, and 2009). The German consultant G. Kroll identified the need for a national SWM Board at a time when municipalities were very deficient in technical, financial, and human resources, which could have contributed to the daunting problem in SWM (Tabasaran, 1976; Tuladhar, 1996). While the proposal to form a SWM Board was meant to reduce the layers of bureaucracy in the three municipalities, in the end it broke SWMRMC as a weak institution and left Kathmandu city as a vulnerable municipality. In 1976, to expedite the legal, institutional, and technical arrangements and to coordinate work between the German contractor and the Nepalese counterparts, the solid waste expert from Germany, Tabasaran (1976), recommended forming a German Project Group consisting of three engineers, one draftsman, and one typist. The goal of this group was to train their counterparts in Nepal. The plan expected this group to dissolve at the end of the first phase. Also, GTZ intended to turn over the SWM Project to the Nepalese side by the end of the second three-year phase, but GTZ continued its presence until 1993. GTZ planned to reorganize SWM in Kathmandu, Lalitpur, and Bhaktapur during the first phase and broaden its coverage throughout Kathmandu Valley in the second phase.

The recommendation called for the Government of Germany to pay the German Project Group's salaries and take up the cost of the heavy machinery acquired, such as collection trucks, tractors, and dozers. The estimated sum of money provided by the German Government in 1976 prices was DM 2,343,280 or about US\$929,000 for the first three years. This amount consisted of salaries for the Project Group, scholarship money for the training of Nepalese engineers, vehicles, and depreciation costs.

Table 2 shows the eight pieces of equipment purchased using German grants. Half of them were already out of commission or found to be inappropriate by mid 1980s. Nippon Koei Co. Ltd. and Yachiyo Engineering Co. Ltd. (2007b) reported that one of the Roll-off tippers is not working and GTZ (1996) relates that two of SWMRMC's dozers were not working and its compactor was unsuitable for waste types in Kathmandu and should be sold. Landfill compactors are heavy machines equipped with knobbed steel

wheels that are normally used to break up bulky items and spread wastes across the surface of a landfill in a thin layer. During the operation of GLS, it was discovered much too late that waste in Kathmandu did not require compactors because it largely contained organic wastes that were already compacted enough. Therefore, the purchase of compactor was an error on the planners' part, and operating the compactor in mostly muddy conditions without trained personnel to make regular and systematic deposits of waste in the landfill cell and run machinery at the site became an issue. Operational difficulty with the Roll-off tipper after almost ten years is understandable, but the difficulties surrounding the dozers and compactor identified by GTZ (1996) raise additional questions about the donor's actions because the equipment was purchased during the GTZ period, and they were aware that the compactor was being used in GLS before GTZ left Nepal in 1993 (Undersecretary, 2009).

Also, because the SWM Project was extended until 1993 and German experts remained in Nepal until this time (GTZ, 1996); it probably drew more foreign assistance from Germany than what was quoted in the report. In the absence of published figures from later phases of the project, the budget of SWMRMC during this period is one source of financial information. In 1989/90 Kathmandu city allocated Nepalese Rupee (NR) 8.3 million and SWMRMC contributed another NR 26.8 million for SWM. Although the absolute amount SWMRMC provided increased to NR 46.8 million in 1995/96, its share of the total started declining in 1991/92. While in 1989/90 SWMRMC's share was 76.4% of the total budget spent on SWM, it was 72.1% in 1991/92 and by 1992/93 it dropped to 51.3% and in 1995/96 it was 46.2%. The departure of German assistance had a direct impact on SWMRMC's budget in 1992/93. Shikura and Harada (2004) report that throughout the SWM Project, GTZ filled the financial gap when the SWM Project failed to raise enough revenue to meet operational needs. SWMRMC collected the largest fees in 1989, representing 30% of its total revenue, and as anticipated, its share of the SWM budget was highest in that year. The sudden budget deficit in 1992/93 was made up by Kathmandu city's ability to increase its share from NR 6.8 million in 1984 to NR 32.8 million. Kathmandu's budget jumped by 152% and SWMRMC's decreased by 41% between 1991/92 and 1992/93 thus indicating the actual subsidy was substantially larger than the recorded subsidy. This period coincides with the SWM problems and events that unfolded after the termination of the SWM Project. The worsening of SWM after the project period, despite some success in the early days of the project and the common perception that there were not as many problems with waste before the project began, show that the GTZ was unable to sustain its effectiveness in Kathmandu.

A Fact Finding Mission by the GTZ (1996) itself concluded that the condition of SWM in Kathmandu in 1996 was very much similar to what it was in 1980 with uncollected and scattered waste in the streets of Kathmandu city and unorganized disposal of waste in

rivers. While the problems in mid 1990s were worse than what they were before the SWM Project began, the statements made by the funding agency create ambiguity about the capacity that it had intended to build in SWM in Kathmandu. Additionally, GTZ concluded that the problems associated with SWM were not technical, but institutional, organizational, and economic and financial (GTZ, 1996). Also, the apparent lack of financial and economic capacity by the agency that started the reorganization of SWM almost 20 years ago hints at an inability to sustain the capacity of SWMRMC.

Tuladhar (1996) reported that technical assistance from donors and reliance in their equipment and aid were among the reasons for SWM failure in Kathmandu city, and he explained that when the Germans discontinued their support, SWMRMC could not raise enough fees to pay its employees and sustain the project. Thapa (1998) shows that the expenditure gap in 1994/95 crippled SWM because the combined budget of SWMRMC and Kathmandu city was NR 22.3 million shy of the actual amount required to collect the 546 m³ of MSW/day. He also pointed out that the large collection machinery donated by Germans became obstacles to the regular resumption of SWM because Kathmandu city could not repair them locally.

These facts suggest that financial sustainability was not a goal of GTZ's aid package. Also, labeling the issue to be non-technical by the funding agency may have been intended to implicate changed political orders. Claims of wrong use of technical equipment simply shows that the agency used incompatible equipment.

Shikura and Harada (2004) conclude that the SWM Project by Germans was a complete failure. They cite the establishment of an autonomous center (SWMRMC) and flaws in assuming that financial sustainability would be achieved by charging for waste services. The problem became critical after 1993 because there was no landfill to deposit waste into and the central government, SWMRMC, and Kathmandu city couldn't agree how to allocate SWM tasks.

The study argues that technology, institutions, and finance created an unsuccessful effort on the part of the Germans (Shikura & Harada, 2004). As for technology, it was inappropriate to require collection vehicles that were costly, complex, and too large for the narrow walks and streets in Kathmandu and to adopt SWM techniques based on developed countries' needs. The failure to institute composting added to the technological reasons for the project's breakdown. The exclusion of Kathmandu city from the very beginning created a problem in the institutional arrangements. Kathmandu city continued to organize the collection and transportation of wastes as the project stimulated less and less confidence among the partners. The national government exhibited poor leadership and the various organizations involved did not cooperate. Expenditures increased because of high overall operating costs for the landfill and compost plant and because of inflation. The unit cost (real cost without inflation) for SWM

Table 2
Record of equipments donated by GTZ^{a,b}.

Equipment (make or model)	Capacity (m ³)	Purpose	Units	Year donated
Roll-off tipper (Mercedes Benz)	14	Secondary transportation	2	1988
Shovel loader	0.75	Secondary transportation	1	
Excavator	0.25	Secondary transportation	1	1986
Chain dozer		Landfill operation	2	1981
Sheep-footed compactor		Landfill operation	1	1988
Dump truck	20	Bulk transportation	1	
Total			8	

^a Manandhar (2005).

^b Nippon Koei Co. Ltd. and Yachiyo Engineering Co. Ltd. (2007b).

decreased from NR 260/m³ in 1985 to NR 65/m³ in 1992. Although there was improvement in unit cost of handling waste by a factor of four, the three-fold increase in the amount of waste collected still led to somewhat of larger expenditures during this period (Spreen, 1993 cited in [Shikura & Harada, 2004](#)). Moreover, revenue collection fell short of operating costs because of the failure to expand paying service areas, exclusion of waste fees from house owners, inability to balance the budget in view of rising operational costs, and opposition to the increases in the fee structure from locals. In response, Kathmandu city gradually increased its SWM budget, while SWMRMC's did not change much. More than 80% of Kathmandu's budget was used for wages and salaries and so it did not have funds for vehicle maintenance and capital investment, which led to the financial failure of the SWM effort ([Shikura & Harada, 2004](#)).

3.2. Indian assistance

After the Germans, India provided Kathmandu and Lalitpur cities with a series of advanced equipment such as dumpers, placers, compactors, loaders, containers, sprinklers, and cranes ([Embassy of India, 2000](#)). [Table 3](#) shows the inventory of equipment provided to Kathmandu city, including primary and secondary waste handling equipment and sewage cleaning apparatus. India provided a total of 53 pieces of equipment, ranging from 15 hydraulic tippers to one suction and one jetting vehicle. However, 30% of this equipment has never been used, notably the suction and jetting vehicles because they do not fit in the narrow streets of the city core areas where they are badly needed ([Manandhar, 2007](#)). [Nippon Koei Co. Ltd. and Yachiyo Engineering Co. Ltd. \(2007b\)](#) remarked that one dumper unit was not working. Also, about the inappropriateness of technology, it was learned that India donated three mechanical brooms, which have never been used ([Manandhar, 2007](#)). The brooms are too expensive to run (using a liter of fuel per km), designed to operate in the opposite direction of traffic, and cover half of the street requiring more manpower to complete the sweeping activities. In addition, many units of unused equipment were seen idle and rusting in the Teku transfer station during subsequent visits. Kathmandu city was unable to incorporate the equipment into SWM because the equipment was not designed for local needs and manual sweeping continued to be the dominant method of waste collection even while equipment donations were pouring in. As [Ogawa \(1996\)](#) states, the technical and human resources in SWM provided by advanced countries to developing countries often do not meet the local needs because there is a tendency to provide the donating countries' outdated equipment, surplus manpower, which displaces workers and

creates unemployment, and for the reason that the aid projects subsidize activities that recipient countries cannot continue.

It is disheartening to acknowledge that Nepali government officials hurriedly accept aid of any kind, and this is one of the major issues in the failure of internationally supported projects in Nepal. By accepting the Indian equipment that cannot be used in Kathmandu's narrow and winding alleyways, the aid recipients replicated the SWM Project's errors. Meanwhile, Indian donors burdened a poor country with useless surplus equipment. In the interviews, the lower level managers at Kathmandu city mentioned that the equipment from India came as a goodwill gesture to the democratic government of 1990 and they did not know much about the equipment. Upper level managers and politicians blamed the earlier administration. [Joshi \(2007\)](#) suggested that Kathmandu city accepted the equipment as a token of appreciation for India's reception of a Nepali official. The timing of the donation of the equipment came shortly after the departure of German aid, so the Nepalese government appears to have accepted this SWM support when the crisis peaked in Kathmandu. While it's clear that the equipment is neither necessary nor useful, Nepali officials do not consult their lower tier managers and analyze the existing inventory before bringing equipment home. A profound gap between Nepali officials who accept aid and their field level staffers as well as gifts of inappropriate equipment are the factors that led to continued misallocation of foreign aid in Nepal.

3.3. Japanese assistance

The Japanese government through Japan International Cooperation Agency (JICA) commissioned a study, "The Study on the Solid Waste Management for the Kathmandu Valley", or also known as Clean Kathmandu Valley (CKV) Study, on January 18, 2004 ([Rana, 2004](#); [MLD & JICA, 2005](#)). The study was scheduled to last eighteen months, ending in June 2005. The aim of the study was to develop a SWM action plan for five municipalities in Kathmandu Valley including Kathmandu city, increase the capacity of SWMRMC, transfer planning technology to Nepalese officials, and improve SWM with a series of pilot projects. The project aims to have action plans in full operation by 2015, and after that, the Nepalese will conduct the project themselves. There was a task force group in each municipality, a technical working group with members from SWMRMC and each municipality, a steering committee at the decision making level of government, and nine members from JICA to conduct the study.

The study called for four phases: Phase I (January 2004) organized the study by assembling the steering committee, technical working group, and task force; Phase II (February–May 2004)

Table 3
Accounting of equipments donated by Indian government^a.

Equipment (make or model)	Capacity (m ³)	Purpose	Units	Year donated
Hydraulic tipper (Mitsubishi Canter)	3	Primary collection	15	1993
Dumper placer (DCM Toyota)	4	Primary collection	8	1994
Dumper placer (Ashok Leyland)	6	Primary collection	4	1994
Dumper placer (Tata)	4.5	Primary collection	3	1988
Multi-compact (Ashok Leyland)	14	Secondary transportation	7	1994
Bach hoe (JCB Loader)	0.75	Secondary transportation	2	1994
Jetting vehicles (DCM Toyota)	3	Sewage cleaning	4	1994
Suction vehicles (DCM Toyota)	3	Sewage cleaning	4	1994
Jetting and suction vehicles (Ashok Leyland)	6	Sewage cleaning	2	1994
Suction vehicles (Ashok Leyland)	6	Sewage cleaning	1	1988
Jetting vehicles (Ashok Leyland)	6	Sewage cleaning	1	1988
Water tanker (Ashok Leyland)	9	Sewage cleaning	2	1994
Total			53	

^a [Nippon Koei Co. Ltd. and Yachiyo Engineering Co. Ltd. \(2007b\)](#).

involved conducting surveys to understand existing waste characteristics and the waste behaviors of households, to design draft action plans, to identify pilot projects, and to transfer the knowledge generated about planning, public relations, behaviors, and capacity to task force members; Phase III (June 2004–June 2005) ran pilot projects and finalized action plans from these experiences; and Phase IV (October 2005–March 2007) monitored and followed up on these projects (Nippon Koei Co. Ltd. and Yachiyo Engineering Co. Ltd., 2007a; MLD & JICA, 2005). The study (Phases I–III) actually lasted 20 months, from January 2004 through August 2005, and the final report was submitted to the Nepalese counterpart in September 2005. Monitoring and follow up tasks were performed after October 2005. The five target areas of the pilot projects identified included: improvement of collection and transportation; promotion of waste minimization; improvement of final disposal planning and operation; promotion of public awareness, behavior change, communication, and education; and development of operation and management capacities (Nippon Koei Co. Ltd. and Yachiyo Engineering Co. Ltd., 2006).

The pilot projects that addressed the improvement of collection and transportation included solid waste collection in selected areas, education about public private partnership in SWM, and training in the use of the transfer station. Although the training in collection methods may have enhanced the theoretical knowledge of some solid waste workers, the fundamental waste handling procedures have not changed. The prospects for public private partnership is very high as shown by the number of organizations involved in SWM and the commitment the organizations expressed during field interviews. However, the government and Kathmandu city haven't established a practice of recognizing and working with private companies until very recently. The upgrade to the Teku transfer station, with its newly built split-level platform, appears impressive, but the platform has not been used regularly and when it was used, several problems were identified including over spilling of waste during loading of secondary transportation vehicle (STV) from platform, lack of ground level marking for drivers' safety in positioning STV, and issues with waste pickers and lack of operational policy for the transfer station in Teku. In addition, the proposed transfer station in Balaju has not been used although it would cut the distance waste is hauled to landfill.

The promotion of waste minimization pilot project consisted of instruction in waste minimization through local awareness and infrastructure. Although numerous community and private organizations are working to increase awareness through local participation, education, and waste services provided to households; curtailing the waste quantity will require SWMRMC and the national government to find an appropriate waste processing facility as well as local residents participating at the source of generation. The follow up of the waste minimization pilot projects by Nippon Koei Co. Ltd. and Yachiyo Engineering Co. Ltd. (2007a) identified the following obstacles to success: the need to improve vermicomposting at Teku, limitation of the community recycling center to only ward 21, inflexible supply of vegetable waste for composting, lack of retention of workforce in composting, need to broaden the market for compost, introduction of alternative biodegradable source into composting, and expansion of its benefits.

The final disposal planning and operation pilot project short listed guidance in landfilling and use of semi-aerobic landfill for improvement. There is a host of issues concerning the inapplicability of designated and proposed landfills (SLS and BLS) from siting criteria to environmental considerations, and the most frightening of all seems to be the continuation of leachate generation. Reliable data about the leachate generation is unavailable for SLS because local rainfall hasn't been monitored accurately in Okharpauwa since 1995 when the place was first selected; however, site visits

confirmed excess leachate generation. Because the new landfill will sit on the bed of Kolpu *Khola* (river) by cutting the oxbow short in a low point in the riverbed, it is likely that it will also result in excessive leachate if thorough preventative measures are not taken.

While the SLS was projected to last only through January 2008 and the BLS was slated to open in July 2009 in the CKV Study, site visits in 2010 and 2013 confirmed that the construction of BLS was moving nowhere and SLS was reopened after being closed from November 2009–July 2011. The BLS is expected to last 20 years with a total cost of NR 2.6 billion for a 32-year period, which includes ten years of post-closure activities. With closure of nearby temporary landfill (Aletar), unexpected reopening of SLS, and uncertainty of BLS; Yusuke (2007) estimated that it would be at least three years before JICA completes construction of BLS, which wasn't initiated until April 2015, thus leading to more chaos. Even with the demonstration of SLS as a pilot project to train Nepalese agencies in landfill operation and management, the establishment of a permanent landfill is far from becoming reality. In addition to acquiring the necessary funding, the construction of BLS is contingent upon the government's ability to fulfill relevant local development projects (Pandey, 2007). People living along the access road and near the landfill have obstructed the operation of SLS over 100 times, some lasting up to 80 days, in the first two years of opening because of the government's noncompliance with the agreement to perform the development work (Nippon Koei Co. Ltd. and Yachiyo Engineering Co. Ltd., 2007a). Given this, the government has found creating a solution for SWM in Kathmandu a difficult task.

The pilot project for promotion of public awareness, behavioral change, communication, and education included training in community mobilization, mass communication, and local education programs. The agencies and organizations involved in this task include Community Mobilization Unit in Kathmandu city, SWMRMC, and the Environment Management Section of MLD, along with many local and international NGOs. However, this is where the entire CKV Study fails because it assumes, "Solid waste management in the Kathmandu Valley faces great challenges not only in relation to the management system but also in gaining public awareness and the participation of the people" (Nippon Koei Co. Ltd. and Yachiyo Engineering Co. Ltd., 2007a, p. 1-1). It is true that a certain level of civic engagement in the process is required to effectively organize SWM, as was the case before the SWM Project, but awareness and willingness to follow instructions does not get Kathmandu city anywhere, if the state does not facilitate the efforts of the people. Even with a lack of awareness and non-cooperation, a well-organized state apparatus might be able to accomplish significant improvements in SWM. Also, the study presumed that people's attitudes about waste are only attitudes about waste. These attitudes may actually be shaped by broader attitudes about the legitimacy and efficacy of the government, about fairness, about caste, about gender, about who is responsible for what in society, and so on. Therefore, the whole basis of the CKV study was weakened by this presumption.

The fifth pilot project addressed the development of operation and management capacity through training in data management for SWM, operational management of action plans, and policy level education in SWM. Indeed, the robustness in data management will steer municipalities to better organize the resource sharing needed for the umbrella concept that demands larger participation and regionalization in SWM. But the study points out that because of the municipalities' financial difficulties; they will require cooperation from SWMRMC, MLD, and donor communities. The policy level training in Japan could help solid waste managers and heads in Kathmandu city, but process will be halted by the lack of dissemination of this knowledge among co-workers, sharing of

expertise with municipalities, and training at the *kuchikar* level where it's needed the most, as well as the frequent changes of managers in the Environment Department and SWM Section of the city.

The monitoring and follow up work in Phase IV aimed to help municipalities and SWMRMC with annual work plans and the progression of SWM through the efficient use of the transfer station and landfill. There were three monitoring periods: finalization of annual work plans in November 2005, mid-term monitoring and evaluation in February 2006, and final monitoring and evaluation in July and August 2006. In all of this monitoring, JICA assisted task force teams in completing the activities outlined in the budget for that fiscal year. Despite this effort, there were planned tasks that lacked execution and these failures were blamed on the changing political situation in Nepal (Nippon Koei Co. Ltd. and Yachiyo Engineering Co. Ltd., 2007a). The follow up work covered many of the pilot projects and their fate remains as discussed earlier. The only things missing were the environmental impact assessment and construction of BLS, both of which were waiting on approval. In general, the JICA is not directly involved after the completion of the monitoring and follow up phase, so currently the real challenge is for municipalities and SWMRMC to expedite the work in annual plans and meet their varied goals by 2015.

All of the projects discussed in this subsection were funded by the JICA, but the actual funding for SWM has not been disclosed. Because the assistance was grant aid, Kathmandu city never required any reporting of disbursement of funds and activities by donors (Manandhar, 2007) and there appears to be no published figures about funds. Nonetheless, nine member CKV staff, continuous participation for 20 months, monitoring and follow up for two and half years, engagement from a broad spectrum of stakeholders, series of pilot projects, and donation of STVs and other equipment indicate that a very large quantity of resources was involved in the project. Out of 38 pieces of equipment donated by Japan (Table 4), 17 STVs and 18 extra containers were purchased using a 2003 Japanese grant that was separate from the CKV Study (Nippon Koei Co. Ltd. and Yachiyo Engineering Co. Ltd., 2007a). In 2003, the total non-project grant aid to Nepal was Japanese Yen 500 million (Embassy of Japan, 2008). The actual amount of this fund used to procure SWM equipment is not known, and out of 21 STVs donated to Nepal under this grant, four were supplied to Lalitpur. Similarly, the non-project grant aid from Japan stood at Japanese Yen 1.5 billion for 2004 and 1.1 billion for 2006. With the CKV Study starting in 2004, the high level of Japanese grant money in that year and in 2006 may have some correlation to the increasing number of pilot projects in SWM.

The exceptionally high level of grant money (NR 726.9 million) included in Kathmandu city's 2004/05 budget, which also showed an expenditure of almost NR 1.2 billion for social programs and infrastructure services, indicates that the JICA was providing aid while SLS was being constructed. Also, JICA's support in SWM in Kathmandu is shown by the acquisition of a grant of NR 70 million for vehicles in SWMRMC's budget of 2004/05, the record of completed projects including JICA's contract of NR 2.1 million for

SLS and NR 1.407 million for Taikabu Landfill by East Consult (2008), and Thakali's (2007) mention of NR 120 million spent for SLS. Moreover, there is evidence that Nepal received other SWM aid from Japan including a \$150,000 grant to support SWM infrastructure and public awareness and \$65,103 to improve Kathmandu city's World Heritage sites and Japanese Yen 1.04 billion in 2001/02 expended for intersection improvements in Kathmandu (Embassy of Japan, 2008). Also, Japan and Nepal reached an agreement on technical cooperation in 2003 and the Embassy of Japan included SWM as one of the major fields in environmental conservation to receive Japanese aid.

Preliminary analysis indicates problems with Japanese aid in coordination between the different kinds of equipment, their applicability, how they operate, and their sustainability. Because there is still a preference toward old multi-compactors and Roll-off tippers using the loader in the ground for secondary transfer of wastes, the split-level platform at the transfer station is not used to engage the full capacity of STVs. In addition, private companies complain that the full volume of the STVs is not used, STV drivers struggle with frequent flat tires, and the STVs' giant size prohibits their use outside Teku except on a few roads in Kathmandu. There is a tendency to manually load compactors and tippers inside Teku and throughout Kathmandu, which makes filling the oversized STVs difficult without operating the platform. When the transfer station is full or closed, waste needs to be transferred from the source and STVs are too big for the inner city neighborhoods that produce much of MSW. Also, the access road to the landfill is a single lane road that is partially blacktopped, damaged by landslides, and painted with mud during monsoon. These vehicles may not be the right choice if the road linking the transfer station to SLS is not improved drastically. These STVs may not be much use to Kathmandu without the addition of another transfer station in the outskirts of the city and use of the split-level platform. So, there is evidence that, in the midst of tradition, Japanese aid projects may meet the same fate as other foreign aid projects in SWM in Nepal, as discussed in the previous subsections. Two Japanese scholars discuss the likelihood of success of foreign aid projects in SWM in Nepal, writing, "... government failed to play a major role ... It first relied on Germany and after Germany withdrew support, it relied on India as a new donor. India was followed by Japan and so on. The government seems to have an easy strategy according to which they allow themselves to ignore all issues unless they find a new donor. We doubt whose problem this is. It must be pointed out that a low level of motivation on the part of the government and the lack of capability to tackle the problem hampered the effectiveness of the aid project" (Shikura & Harada, 2004, p. 88).

Although total amount of foreign aid received for SWM in Kathmandu could not be quantified, they have been significant over time. For example, international aid made up \$3.4 million or 52.3% of city's total expenditure in 2000 and \$2.1 million or 40.4% of its total expenditure in 2001 (Manandhar, 2002). The amount of aid was 170% and 105% of the annual SWM budget for 2000 and 2001, in that order.

Though foreign aid makes up much of the SWM budget in any

Table 4
Inventory of equipment Japan donated to Kathmandu city^a.

Equipment (make or model)	Capacity (m ³)	Purpose	Units	Year donated
Multi-compactor	4	Primary collection	1	
Multi-compactor	4	Primary collection	2	2002
Waste containers	15	Primary collection	18	2005
Multi-compactor (Ashok Leyland)	15	Secondary transportation	17	2005
Total			38	

^a Nippon Koei Co. Ltd. and Yachiyo Engineering Co. Ltd. (2007b).

given year, in the aggregate, there is still a low level of public knowledge about the use of SWM aid in Kathmandu as described by survey respondents. Only 14% replied that they know about foreign support in SWM while 84% of people answered that they are not aware of any aid programs. Of the people who were aware of aid in SWM, a roughly equal number of respondents had knowledge of the recent aid from Japan and the past aid from Germany. In another question about the mishandling of money in foreign aided projects, 97% of people who replied described having knowledge of corruption in applying the aid money and 3% mentioned the underutilization of and incapacity to employ the resources.

Also, the most recent consultation with the Environment Department of Kathmandu city confirmed that while the Government of China provided some heavy machinery for collection and transportation of MSW and the European Union has been promoting partnership between NGOs and government in SWM, Kathmandu city is still utilizing the reopened temporary landfill (SLS) and the BLS has not been constructed yet (Shrestha, 2015).

4. Conclusions

The government's choices of technologies and support programs based on donor countries' wrong assumptions have led to failed projects in SWM in Kathmandu. Successful SWM projects depend on selecting applicable technologies and equipment as well as implementing appropriate management and oversight techniques. This research found three instances of Nepali aid recipients' acquisition of heavy machinery that couldn't be used effectively as SWM aid. There is evidence that these aid packages have been more donor driven and the transactions are less transparent and are not shared with Kathmandu city. At the same time, the willingness of the Nepali government to accept whatever aid is offered without consideration of actual need and capacity certainly contributes to the continuing failures. SWM projects have failed because everything from allocation of resources, managerial priority, assessment of internal capacity, duration of projects, creation of parallel national organization, capacity building, and addressing environmental concerns have gone wrong. SWM in Kathmandu struggles because there are no policies and procedures to harness aid for appropriate solutions at the local level, thus wasting the efforts.

5. Recommendations

Since imported techniques and technologies have not worked in undertaking SWM in Kathmandu, the steps to fixing it require plans that outline the necessary resources, where they come from, how they will be sustained, and who will manage the solutions. Kathmandu has a unique resource in its *kuchikars* with their long experience in SWM. Given that and the physical layout of the city with its narrow alleyways and crowded medieval structures that make up most inner-city residences, and Nepal's social tradition of prioritizing local mores and values, a simple and more labor intensive technique in SWM is feasible. With the appropriate allocation of training and pay raises, the Environment Department of Kathmandu city can tap into the experience, knowledge, energy, and interests of *kuchikars* to devise and implement new measures for handling MSW. In this new arrangement, Kathmandu households would be divided into five to six different zones, and the city's Environment Department would employ the existing *kuchikars* in each zone. The *kuchikars* will work with local NGOs and community organizations that specialize in composting, resource recovery, and minimization of waste in the zones. *Kuchikars* will sweep and compile street waste, and representatives of local NGOs will participate in house-to-house collection. Then waste will be delivered to a designated facility within the zone where it will be

categorized as organic, recyclable, and residual wastes. Organic wastes will be processed for composting at the facility, recyclables will be bundled for delivery to *kavadi* shops, and residuals will be deposited in landfills. A special arrangement between NGOs and the Environment Department would strengthen and institutionalize these practices and the gradual implementation of a fee structure would provide financial sustainability. In the beginning, MLD should allocate a portion of local development fees for this plan.

The informal sector addresses 10% of SWM needs in Kathmandu city and 15% in Kathmandu Valley and every year it injects NR 371 million in national economy (Bhattarai, 2003). Wilson, Velis, and Cheeseman (2006) emphasize that it's almost impossible to establish formal waste management in developing countries by rooting out informal sector. Therefore, the experience and large range of existing scavengers and informal waste pickers should also be used to solve Kathmandu's MSW problem. First, these workers should be registered with Kathmandu city and allowed to work at composting facilities. While *kuchikars* will be on salary from the city, wages of house-to-house waste collectors initially will come from a share of local development fees from MLD, but will become the responsibility of NGOs sustained by waste collection fees. Scavengers will profit from their sales of recycled goods. The abundance of established *kavadi* dealers will promote efficiency in recycling. Kathmandu city should allow private companies to bid on handling commercial, institutional, and non-hazardous industrial wastes and wastes from outlying areas of the city. The Environment Department and SWMRMC can coordinate on the research and marketing of compost and recycling.

Hefty acquisition of foreign equipment and landfilling should be discouraged as much as possible. Existing temporary landfills should be used for disposal of any residual wastes using Kathmandu's current STVs; however, if a permanent landfill does not come into operation, a regional landfill within Kathmandu Valley serving the five municipalities should be sought with greater care and local public confidence. Even then, the landfilling amounts should be carefully analyzed and wastes should be diverted away from landfills in all possible ways. Then only, Kathmandu city can request international assistance and experience from donor communities to devise a landfill and appropriate equipment for both the landfill and local conditions. A careful implementation of these recommendations will improve the immediate problem of SWM in Kathmandu city by providing an opportunity to draw on the special skills of *kuchikars* together with thriving local NGOs and private groups.

Acknowledgments

Francois Fiessinger Fellowship partially funded the research. Tribhuvan University faculty and students assisted in the field study. Basant Buddthoki performed additional data collection in April 2015. We also acknowledge anonymous reviewer and Professor Charles L. Choguill for their contribution to enhance the quality of the paper.

References

- Bhattarai, R. C. (2003). *Problems and prospects of informal sector for reuse and recycling of waste in Kathmandu*. Paper presented at the 18th International Conference on Solid Waste Technology and Management, Philadelphia, March 23–26.
- Dangi, M. B. (2009). *Solid waste management in Kathmandu, Nepal: The anatomy of persistent failure*. Doctoral dissertation, the Johns Hopkins University. Ann Arbor: ProQuest LLC.
- Dangi, M. B., Cohen, R. R. H., Urynowicz, M. A., & Poudyal, K. N. (2009). Report: searching for a way to sustainability: technical and policy analyses of solid waste issues in Kathmandu. *Waste Management & Research*, 27, 295–301.

- Dangi, M. B., Fernandez, D., Bom, U. B., Belbase, S., & Kaphle, R. (2015). Evaluation of environmental impact assessment report preparation and public participation in landfill projects in Nepal. *Habitat International*, 46, 72–81.
- Dangi, M. B., Pretz, C. R., Urynowicz, M. A., Gerow, K. G., & Reddy, J. M. (2011). Municipal solid waste generation in Kathmandu, Nepal. *Journal of Environmental Management*, 92, 240–249.
- Dangi, M. B., Urynowicz, M. A., & Belbase, S. (2013). Characterization, generation, and management of household solid waste in Tulsipur, Nepal. *Habitat International*, 40, 65–72.
- Dangi, M. B., Urynowicz, M. A., Gerow, K. G., & Thapa, R. B. (2008). Use of stratified cluster sampling for efficient estimation of solid waste generation at household level. *Waste Management & Research*, 26, 493–499.
- East Consult (P) Ltd. (2008). *Environmental project*. http://eastconsult.com.np/index.php?module=env_pro Accessed 31.10.08.
- Embassy of India. (2000). *Indian aided projects in Nepal an overview: Other sectors*. <http://www.south-asia.com/Embassy-India/indneprel.htm> Accessed 30.09.08.
- Embassy of Japan. (2008). *Economic cooperation: Grant assistance to Nepal*. <http://www.np.emb-japan.go.jp/oda/grantlist.html> Accessed 26.09.08.
- Flintoff, F. (1971). *Assignment report on solid waste management in Kathmandu*. New Delhi: WHO.
- GTZ. (1996). *Solid waste management in Nepal: Report on the fact finding mission for the project PN 93.2203.3–01.100*. Kathmandu: GTZ.
- Joshi, N. R. (2007 July 21). *Personal communication*.
- Manandhar, R. (2005 June 1). *Basic fact sheet of solid waste management of Kathmandu Municipal Corporation*. Unpublished record received electronically.
- Manandhar, R. (2007). July 24. *Personal communication*.
- Manandhar, R. (2002). *Private sector participation in solid waste management in Kathmandu*. Paper presented at Kitakyushu Initiative Seminar on Solid Waste Management, Kitakyushu.
- MLD, & JICA. (2005). *About CKV study*. <http://www.mld.gov.np/swm/ckv/study/Study.html> Accessed 09.06.05.
- Nippon Koei Co. Ltd., & Yachiyo Engineering Co. Ltd. (2006). *The study on the solid waste management for the Kathmandu Valley (monitoring and follow-up phase), draft final report volume I: Executive summary*. Kathmandu: JICA.
- Nippon Koei Co. Ltd., & Yachiyo Engineering Co. Ltd. (2007a). *The study on the solid waste management for the Kathmandu Valley (monitoring and follow-up phase), final report volume II: Main report*. Kathmandu: JICA.
- Nippon Koei Co. Ltd., & Yachiyo Engineering Co. Ltd. (2007b). *The study on the solid waste management for the Kathmandu Valley (monitoring and follow-up phase), final report volume III: Supporting report*. Kathmandu: JICA.
- Ogawa, H. (1996). *Sustainable solid waste management in developing countries*. Paper presented at the 7th ISWA International Conference and Exhibition, Yokohama.
- Pandey, R. (2007). July 19. *Personal communication*.
- Rademacher, A. (2007). A 'Chaos' ecology: democratization and urban environmental decline in Kathmandu. In M. Lawoti (Ed.), *Contentious politics and democratization in Nepal* (pp. 299–321). Delhi: Sage Publications.
- Rademacher, A. (2008). Fluid city, solid state: urban environmental territory in a state of emergency, Kathmandu. *City & Society*, 20, 105–129.
- Rademacher, A. (2009). When is housing an environmental problem? Reforming informality in Kathmandu. *Cultural Anthropology*, 50, 513–533.
- Rana, S. (2004). Clean Kathmandu Valley Study: Sapha sahar hamro rahar (clean city is our desire). *JICA Nepal Office Newsletter*, 32, 4–4.
- Scheaffer, R. L., Mendenhall, W., III, & Ott, R. L. (2006). *Elementary survey sampling*. Belmont: Thompson Higher Education.
- Schoenberger, E. (1991). The corporate interview as a research method in economic geography. *Professional Geographer*, 43, 180–189.
- Shikura, S., & Harada, H. (2004). Challenge of solid waste management in developing countries: what should we learn from experience in Kathmandu, Nepal? *Bulletin of Maizuru National College of Technology (MNCT)*, 39, 82–92.
- Shrestha, R. M. (2015). April 19. *Personal communication*.
- SWMRMC. (2005). *Introduction of SWMRMC*. <http://www.mld.gov.np/swm/aboutus.htm> Accessed 27.02.08.
- Tabasaran, O. (1976). *Experts report on the reorganization of solid waste disposal in the Kathmandu Valley especially in the cities of Kathmandu, Patan and Bhaktapur*. Stuttgart: GTZ.
- Thakali, B. (2007). August 1. *Personal communication*.
- Thapa, G. B. (1998). Lessons learned from solid waste management in Kathmandu, Nepal. *Habitat International*, 22, 97–114.
- Tuladhar, B. (1996). Kathmandu's garbage: simple solutions going to waste. In P. Onta, M. D. Chene, L. Onta-Bhatia, & M. Liechty (Eds.), *Studies in Nepali history and society* (pp. 365–393). Kathmandu: Mandala Book Point.
- Undersecretary, MLD (2009). January 5. *Personal communication*.
- Wilson, D. C., Velis, C., & Cheeseman, C. (2006). Role of informal sector recycling in waste management in developing countries. *Habitat International*, 30(4), 797–808.
- Yusuke, T. (2007). August 1. *Personal communication*.