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Solid Waste Management Knowledge, Attitude, and Practices: A Case from the Residents of Khuruthang under Punakha, Bhutan

Namgay Thinley[1*]

Abstract

Rapid economic expansion, unchecked urbanization, and rising population of Bhutan have made the collection and treatment of municipal solid waste a multidimensional problem. Generation of wastes and difficulty in finding space for appropriately disposing solid wastes are issues in almost all the urban areas. This study investigated residents' knowledge, attitude, and practices of solid waste management (SWM) in Khuruthang under Punakha Dzongkhag, Bhutan. The study also examined the perceptions of the residents' on managing solid wastes. In addition, relationships between residents' SWM knowledge, attitude, and practice were identified. The study was conducted based on pragmatic paradigm, guided by exploratory sequential mixed methods. Quantitative data were collected using simple random sampling method from 91 residents and the qualitative data were collected using stratified purposive sampling from 7 residents of Khuruthang Throm. The findings of the study showed that the residents of Khuruthang Throm demonstrated a high level of SWM knowledge, positive attitude, and practice in waste management regularly. However, there are concerns over the lack of adequate facilities such as the availability of municipal trucks and proper landfill areas for waste disposal. The findings indicate that there is a need for vigorous advocacies on SWM related laws and policies, investments in waste management facilities like recycling, composting, and sanitary landfills.

Keywords: attitude, knowledge, management, practices, solid wastes

Introduction

World Health Organization (WHO, 2021, p.1) defines solid waste as any type of garbage, trash, refuse or discarded material. It can be categorized according to where the waste is generated, for example as municipal solid waste, health care waste, and e-waste. In Bhutan, solid waste has become an issue due to urbanization and changing lifestyles. Bhutanese are generating waste at an alarming rate especially in municipal areas. By 2037, it is projected that half of the total population in Bhutan will be residing in urban areas (National Environment Commission [NEC] & National Statistics Bureau [NSB], 2019). The report also found that households in urban areas of Bhutan are generating on average 0.253 kg/capita/day of solid waste, 2.401 kg/commercial unit/day by commercial sources

[1] Dashiding Higher Secondary School, Lobesa, Puna kha, Bhutan
*Corresponding Author: *namgaythinley85@education.gov.bt*
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and 0.207 kg/staff/day by offices. This will double the generation of waste and pose a serious issue of waste management. Thus, waste management has become an important issue to be addressed in Bhutan.

Prior to early 2000, majority of Bhutanese population resided in rural areas, thus the disposal of wastes did not pose a significant problem. However, with urbanization, concentration of population in urban areas and changing consumption pattern of people are increasingly becoming harmful to environment (Shrestha, 2018). According to Shahzadi *et al.* (2018), 2.6 billion people (39.0%) of the world population do not use proper methods of waste disposal and about 1.1 billion people still dispose their waste in open areas. This is due to the lack of knowledge of proper waste management practice, therefore, knowledge on adequate waste management is deemed important.

Bhutan has regulations and programs in place to regulate and sensitize solid waste management,but still faces the problem of managing unsegregated wastes. Changes in consumption pattern due to advancement in socio-economic activities have increased waste generation. Further, lack of civic responsibilities and self-awareness are contributing to the problems of managing solid wastes. It is common to find garbage being dumped along downhill sides of roads, solid wastes thrown in rivers, and landfills amassed with huge amounts of rubbish (Ghalley, 2017). Solid waste management is a rising concern in urban as well as rural areas of Bhutan. According to Rinchen and Chhetri (2006), solid waste generation has increased from 8-10 metric tons to 36 metric tons per day in Thimphu alone and the survey conducted from November 2007 to January 2008 showed that the solid waste generated in urban centers is 0.53 kg per capita, and 58% of the total solid wastes are organic. Additionally, a study conducted by Norbu *et al.* (2010) on municipal solid waste characterization and management in Phuentsholing found that 71% of the total wastes constituted solid wastes. In most parts of Thimphu, wet/biodegradable waste is collected once a week and dry waste twice a week.Storing wet waste for six days is not hygienic and is practically a challenge for many families. Thus, lack of adequate knowledge on waste segregation and proper solid waste management practices will pollute environment. SWM is a critical issue in Khuruthang like in many other urban centers in the country. Khuruthang under Punakha is expanding and so is the waste. Indiscriminate waste dumping hascreated unpleasant surroundings in the town. Lack of proper waste management and availability of small garbage collectors are what the residents are concerned about (Dema, 2013).

Applying SWM knowledge on waste segregation is a challenge at homes and market areas although impressive and promising advocacies on waste management and social services are initiated by schools in communities. In addition, according to NEC (2019), there is a shift in food habit of Bhutanese from a more organic and self-sustaining society to a wasteful society. Therefore, this study on the residents of Khuruthang under Punakha Dzongkhag intends to provide residents' level of SWM knowledge, attitude, and practices.

Materials and Methods

Study area

This study was conducted in Khuruthang Throm, which is under Guma Gewog. Out of eleven Gewogs under Punakha Dzongkhag, Guma Gewog is the most populated due to Khuruthang Throm (Figure 1). Khuruthang Throm serves as the main market for the people of Punakha and Gasa Dzongkhag. Khuruthang Throm provides different institutional facilities such as banking, schools, and legal consultancies apart from business, residential, and recreational opportunities. Hundreds of people gather from Friday evening until Saturday afternoon to buy vegetables and to trade their products. Besides serving the people in and around the Throm, traders from as far as Bumthang, Paro, Sarpang, and Thimphu come for trade. Thus, the amount of solid wastes produced in Khuruthang Throm

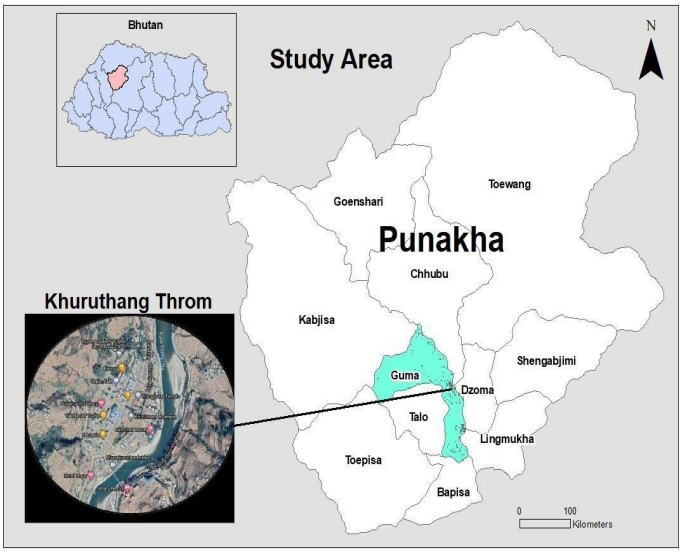

Figure 1: Location of the study site

is increasing as the business is booming and urbanization is rapid.

Research paradigm, approach and design

This study was guided by pragmatists worldview. To study the level of residents' SWM knowledge, attitude, and practice, both numbers and understanding of residents on the study were found unavoidable. The pragmatists approach helps in presenting the study in both numbers and words, which are equally important to be deployed in studying and interpreting the residents' SWM knowledge, attitude, and practice. Similarly, Creswell and Creswell (2018) discussed that pragmatism as a worldview arises out of actions, situations, and consequences rather than antecedent conditions (as in post-positivism). Adopting an explanatory mixed method approach, the study administered survey questionnaire to the residents of Khuruthang. The study obtained quantitative data through a five-point Likert scale questionnaire from ninety-one residents. The survey questionnaire consisted of three broad themes; solid waste management knowledge, attitude, and practice. Each of these themes was further divided into sub-themes. Fifty-eight items were used to collect quantitative data. Following the findings from the analysis of the quantitative data, necessary changes were made to the interview questions as mandated according to the research approach chosen. The qualitative data were collected through one-on-one interviews with seven residents.

Data analysis methods

The data were analyzed using SPSSV22. Findings are shown through tables and figures. Thematic analysis technique of Clarke and Braun (2018) was used to analyze interview data as seen appropriate to the Interpretivist epistemological paradigm. Smartphone was used to record the interviews. Audio-recorded interviews were transcribed and coded using descriptive coding. Codebook was maintained to merge the codes to develop themes or categories that became the units of discussion. The findings from the two sources were triangulated to gain a clearer and holistic understanding of the issues. For identification, the participants for the interview data were coded as P1, P2, P3, P4, P5, P6 and P7.

Results and Discussion

Residents' perceptions of Solid Waste Management

The respondents consisted of shopkeepers, vegetable vendors, civil servants, and scrap dealers. The findings showed that most of the residents of Khuruthang are aware about types of wastes generated from their households and community and take responsibility for their waste. For instance, respondents from the vendors and civil servant categories assert that

> "…residents in Khuruthang are well informed about the type of waste that generate from houses, from shops, or the nearby areas. It seems that some of them know and are aware of the waste management whereby they segregate their wastes from their home itself." P5 and P6.

Findings on perceptions of SWM are consistent with the findings of Rahardyan *et al*. (2004)

Table 1: Correlation between Knowledge, Attitude and Practices

	Knowledge	Attitude	Practices
Knowledge	1		
Attitude	.30**	1	
Practices	-0.09	.28**	1

** Significant at 0.01 level
N = 91

where the study was conducted on residents' concerns and attitudes towards SWM facilities in Japan. Of many concerns, the study found that pollution and health effects had the highest rating,followed by reliability of the waste management facilities, damage to nature, and cost of managing wastes. In addition, the study also suggests that the rating was different between different municipalities, reflecting their social and geographic background. So, it is plausible to conclude that the geographic location and the social background of the people influence their perceptions of solid waste management (SWM) practices and residents' attitudes in their locality. However, the findings of the study are inconsistent with the similar study on people's perception of household SWM in Ojo Local government premises by Longe *et al.* (2009). The researchers found that the public opinion and perceptions on the SWM system are characterized by irregularity and inefficient collection system; with poor monitoring of the private waste service providers by the local authority.

Some (*n* = 3) of the residents of Khuruthang Throm felt that people need to take waste management seriouslyand become more responsible. The residents (*n* = 5) perceive that waste segregation should be prioritized to reduce the wastes going to the landfill and its related impacts. A respondent from shopkeeper category pointed out that,

> "…It has been a problem as tenants ignore their waste management during the absence of owners." P2, P3, and P6.

It has been observed that the solution for the waste problems in the past as well as at present has been temporary, which is evident from the explosion of the only landfill in the Throm. Despite disseminating information through awareness program, it seems people were not aware and interested in waste management. The respondents (4) believe that it is the duty of the building owners to manage their wastes.

Thefindings corroborate with the findings of Tshomo *et al*. (2020) where they argue that currently, in Bhutan, a systematic approach of integrated solid waste management, which addresses all processesof SWM cycle and sustainability aspects are not in place owing to inadequate institutional set-up, lack of skilled human capacity, and access to limited financial resources. The Ministry of Works of Human and Settlement (MoWHS) (2008) report also supports the finding where improper segregation is a major issue. Similarly, NEC (2019) highlighted that in most Dzongkhags the common practice of solid waste management is open burning or dumping in an open landfill. Waste segregation and recycling are minimal in most *Dzongkhags* and collection of recyclable materials take place on an informal basis. Therefore, the rise in both quantity and quality of municipal solid waste in Bhutan are subject to growing management problems, which need attention at large in managing waste issues in the country.

Relationship between residents' SWM Knowledge, Attitude and Practices

A significant positive correlation (r_s = .30**) was found between residents' SWM knowledge and attitudes towards SWM. This shows that when residents have High knowledge of SWM, it leads to a positive attitude towards SWM. Similarly, there is a weak positive correlation between residents' attitude towards SWM and their SWM practices (r_s = .28**). However, there was no significant correlation (r_s = -.09) between residents' knowledge of SWM and their practices (Table 1).

Haider *et al.* (2015) also found similar finding where a positive correlation is found among waste management knowledge, attitude, and practices. Their study reveal that education positively correlate with the thinking of re-

Table 2: Attitude, knowledge and practices of solid waste management (SWM)

SWM categories	Items	Mean (SD)
Practices	Reuse	3.47 (±0.75)
	Reduce	3.85 (±0.63)
	Recycle	3.21 (±0.89)
Attitude towards	Environment	3.94 (±0.42)
	Waste management responsibility	4.09 (±0.42)
	Waste management practices	3.97 (±0.47)
	Waste management policies	4.27 (±0.49))
Knowledge on	Waste categories	2.92 (±0.268)
	Waste segregation	2.95(±0.229)
	Impacts of wastes	3.00 (±0.000)

spondents about dumping and waste recycling practices. Further, the study also confirm that SWM knowledge in people leads to a positive attitude of people towards waste management. Although the positive attitude in turn can shape the SWM knowledge and practices, the study found no relationship between knowledge and practice.

Solid waste management practices

The descriptive statistics show a total mean value of 3.51(*SD* = 0.76) indicating that residents in Khuruthang Throm engage in positive SWM practices. A comparative study of the mean among various practices of therespondents revealed that the residents practiced reduce and reuse with a mean value of 3.85 and 3.47 respectively compared to recycling 3.21 (Table 2). Similarly, the thematic analysis showed that most (n = 5) of the participants use the reuse practice in managing their wastes. The thematic analysis show that the majority of the residents wash and reuse plastic bags and bottles, as they are helpful and convenient to both the environment and users. However, quite different from the quantitative results on recycling practice of wastes $\bar{x}$ = 3.21, which was rated high, thematic analysis also show the need of introducing recycling services in the Khuruthang Throm. The thematic analysis pointed out that the unavailability of recycling facilities in the Khuruthang Throm causes inconveniences to recycle wastes. As a result, the residents choose to either reuse or dump their wastes depending on the nature of the wastesthey produce. The thematic analysis show

> "I practice reuse of plastics to reduce the amount of wastes going to the landfill. I do not recycle because we do not have recycling facility here. For me, I use the reduce method the most. For example, buying shampoo in a bottle instead of a package." P7 and P3.

This finding corroborates with Pholose (2019) who also stated that reusing waste is the most effective measure to manage solid waste. Reuse saves money, resources, and protects environment. Reuse requires less energy as compared to recycling. Reusing equipment or material for its original or same purpose without changing its physical form prevents waste from being sent to landfills (Zero Waste South Australia, 2016, as cited in Pholose, 2019). According to U.S. Environmental Protection Agency (USEPA) (2016), about34.6% of waste thrown away in America is recycled. Recycling waste in America reduces 186 million tons of carbon dioxide equivalent emissions annually. Therefore, solid waste services such as recycling, composting, sanitary landfills, and incineration are required.

Attitude towards Solid Waste Management

The study also intended to examine the residents' attitudes towards SWM in Khuruthang Throm. The descriptive analysis indicated that the residents had a positive attitude towards SWM. The mean for attitude towards waste management was 4.07 (*SD* = 0.45). Similarly, the residents were willing to collaborate with the municipal in managing solid wastes. De-

spite the positive attitude of the residents towards SWM, the need of residents' attitude towards managing solid wastes require improvement.

The findings of the study aligns with the study of Shahzadi *et al.* (2018) where the study found out that 84.0% of the respondents agree that proper waste disposal is important. The study also showed that 95.0%of the respondents felt streets should be clean and 71.0% of the respondents agreed to be aware of improper waste disposal affecting human life. Adeyemo and Gboyesola's study (2013) on SWM knowledge, attitude, and practice of Ogbomoso campus residents showed that the residents have a positive attitude towards waste management. A positive attitude towards SWM contributes positively towards properwaste management. As discussed above, rapid urbanisation and changing lifestyles of people are likely to lead to a poorly managed and uncontrolled waste management.

Residents' Solid Waste Management Knowledge

To study the level of SWM knowledge among the residents, the household survey questionnaire was categorized into three themes (Table 2). The descriptive statistics results indicated a high level of waste management knowledge of the residents. The study suggests respondents are aware of the impacts of solid waste ($\bar{x}$ = 3.00 and SD = .000). The total mean for residents' waste management knowledge was 2.96 (SD = 0.17) on a 3 point Likert scale. The thematic analysis highlighted environmental hazards as an important issue related to poor waste management knowledge. Further, it was learned that lack of knowledge on waste management will make people irresponsive which in turn will pollute the environment in the long run. For example, respondent from vendor category shared about the importance of knowledge on waste management as:

> "If we are not responsible for our waste, I think the town will become fully filled with wastes and even the cattle will not have room to feed and roam. Secondly, it will also hamper maintaining the cleanliness of our river." P1.

The findings of the study corroborate the argument forwarded by Taiwo *et al*. (2008) and Pholose (2019) that, SWM is a challenge in developing countries. The issue of SWM is a challenge for Khuruthang Throm and its residents. The findings are similar to that reported by Adeyemo and Gboyesola (2013), wherethe residents have high knowledge (91.7%) about refuse waste management. A similar study in Northern Thailand by Laor *et al*. (2018) revealed that 73% of highland residents had a high level of waste management knowledge. Tian *et al.* (2019) claimed that consumer knowledge plays a significant role in moderating the effect of perceived behavioural control on waste classification intentions. Similarly, according to Ferronato and Torretta (2019), the environmental effect of waste are pervasive worldwide: marine litter, air, soil, and water contamination, and the direct interaction of waste pickers with hazardous waste are the most important issues.

However, the findings of high solid waste management knowledge of the study (see Table 4) contradicts with the findings of Chakraborty *et al*. (2018) and Tshomo *et al*. (2020) who also studied on the wastes issues in Bhutan. The authors found that people lack waste management knowledge and litters the places they live in. The difference in the findings could be attributed to the differences in sample size and study area. Further, it could also mean urban centers with high population do have more solid waste issues than the small towns with less population.

Conclusion

The respondents in this study were assessed on knowledge, attitude, and practice of Solid Waste Management (SWM). The findings of the study showed that the residents of Khuruthang Throm demonstrated a high level of SWM knowledge ($\bar{x}$ = 3.00 and SD = .000), positive attitude ($\bar{x}$ = 4.07 and SD = 0.45), and

practice ($\bar{x}$ = 3.51 and *SD* = 0.76) waste management regularly. Although it was found that the residents manage their wastes, there is a need for vigorous advocacies on SWM related laws and policies, investments in waste management facilities like recycling, composting, and sanitary landfills. The study also found the need of using separate waste bins for different wastes to segregate the waste from the source. This can avoid toxics from waste and waste related hazards. Further, it can prevent all types of wastes going to the single landfill. Thus, the only landfill in the Throm can be managed sustainably.

Enhancing public awareness and education on waste management and its related laws and policies were found required. Similarly, providing waste category options such as composting for managing organic wastes, drop-off centers, and separate municipal truck and landfill for degradable and non-degradable wastes are also requirements found to manage the wastes. There is also a need to encouraging entrepreneurship on waste recycling.

There is a scope for the future researchers to explore issues related to waste through larger sample size and study design. Similarly, since this study emphasizes on understanding the waste management knowledge, attitude and practices of the residents, other potential factors like the structural design and planning are not covered, which might have a greater impact on waste management.

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