

Study on Solid Waste Generation and Management of Squatter Area along Ring Road of Kathmandu Valley in Nepal

Prasant Sah¹, Abhiniti sah², Dr Khatraj Daha³

1. Prasant Sah, Senior lecture, Hileside college of engineering,
2. Abhiniti sah, Assistant lecture, Hileside college of engineering,
3. Dr Khatraj Dahal, Professor, Hileside college of engineering,

Crosponding author: Prasant Sah, Senior lecture, Hileside college of engineering,

Received 05 August 2023; Accepted 18 August 2023

ABSTRACT

Background: Solid Wastes are discarded wastes and are generated from different sources such as sludge from a waste water treatment plant, water supply treatment plant or air pollution control facility and other discarded materials, business and industries, agricultural and community activities. Similarly, urban slums are the result of the rowing pace of urbanization and lack of affordable housing. Managing solid waste in the urban slum area is a major issue concerning Municipal Solid Waste Management. Poor sanitation, drainage and garbage disposal systems degrade the environment which results in hazards both to the physical and mental health of people living in slums area. The research was conducted during the period of 20 Slums areas within the ring road of Kathmandu Valley of Nepal. Field observation, In-depth interviews, focus group discussion and Questionnaire survey were the major instruments used during the investigation. The problems caused due to improper solid waste management in a slum area within the ring road of Kathmandu city have increased in loss of aesthetic beauty and tourism industry, people's attitude and behaviors and as well as flooding/inundation during monsoon season (RII=0.71) for the people living there. The cause of an inadequate number of waste-collecting vehicles is the insufficient budget (RII=0.71). The cause of the loss of aesthetic beauty is due to the dumping of solid waste in the streets and bank of rivers (RII=0.71). The cause of negative impact on public health is due to the dumping of solid wastes in streets and on banks of rivers, with no strict action for open dumping and burning of the wastes (RII=0.71). The cause of the emission of greenhouse gases is due to methane release from landfill sites (RII=0.72). The study would like to suggest that the government should come up with proper plans and policies along with the enforcement and strict monitoring of the prevailing rules and regulations. Planning should be conducted at every stage and tracking should be done.

Keywords: Solid waste management, Slum Area, Waste segregation, Recycling and Reuse.

I. INTRODUCTION

Squatters grow and form in many different parts of the world. According to the United Nations Human Settlements Program (UN-HABITAT), around 33 per cent urban population in the developing world in 2012 lived in squatters. The world's population lives in urban areas is more than half and by 2030 it is projected that over half of residents in low- and middle-income countries (LMICs) will reside in cities [1].

The UNDP (2014: p. 27) states that poverty is rising in urban areas, and results in declining of poverty in rural areas. As rural residents move to urban areas in the pursuit of happiness and prosperity. The search for a better life brings a huge number of poor people to the urban areas in the pursuit of happiness and prosperity and also for a job. As a result, villages are overtaken by expanding urban areas, and many low- and middle-income countries are increasingly concerned with the urbanization of poverty [2]. Squatters are an outcome of the rapidly increasing growth of the urban population which poses an imbalance in urban growth. Squatters are one type of settlement that is illegally occupied houses and create a nuisance of environmental pollution grown on public land in urban areas. It generally grows near Airports, Railway stations, river floods and near market areas, etc. Population living in squatters is the proportion of the urban population living in squatter households. The main reasons for squatter development are industrial revolution after independence. Before 1950 squatters were predominantly found around mills, factories etc. They were mostly industrial workers in one-room tenements [3]. Among of total municipalities budget, 10% is used for SWM, 60%–70% is used for street sweeping and collection, 20%–30% for transport, and the rest for final disposal [4]. Individuals living under the same roof lacking one or more of the following conditions: access to improved water, access to improved sanitation, sufficient living area, housing durability, and security of tenure”.

Squatters have risen dramatically. Globally population living in squatters (% of the urban population) constitute 29.244. The squatter population in urban areas is increasing day by day, has increased in absolute numbers from 1.2 million in 1990 to 3.1 million in 2009, and reduced again to 2.8 million in 2014 [5]. In 2005, Kathmandu city's 137 squatter neighborhoods are identified with 6,985 households and 31,463 people. In Nepal such as Kathmandu and Pokhara, as well as in urban areas such as Dharan, Birganj, Bharatpur and Mechinagar are fast-growing areas. In 1985, the Kathmandu Valley 17 squatter settlements increased to 64 by 2003 [6]. UN-HABITAT (2010: p. 9) states that in 2010, Kathmandu city has there 40 squatter's settlements with over 12,000 squatters, and an additional estimated 40 per cent of squatters around 20,000 are occupying public buildings. In 2012, 29 riverside squatter settlements with 2031 households, and 17 settlements in other locations with 467 households are in Kathmandu city.

However, Kathmandu Valley is the hub of Nepal's urbanization among all the urban centers in Nepal. The total population of Kathmandu city is over 1 million and recorded alone the highest density of 19,726 persons per sq. kilometer in 2011. In alone there are 63 squatter and squatter settlements. For the rural residents' people, the city is expensive compared to a village. So, it is difficult for the urban poor to live in cities by lacking minimum basic amenities. So, they need protection and care from the state [7].

In the context of Nepal, the major challenge of urbanization is managing solid waste. Nepal is facing difficulties with the provision of basic services such as water supply, wastewater treatment, and solid waste management in urban areas. Municipalities are unable to manage their responsibilities effectively i.e., Collection, transport, treatment, and final disposal of solid waste because of the lack of technical and human resources, statistical records, and proper planning, as well as insufficient budget and lack of political leadership.

The general objective of this study is to analyze the solid waste generation and management of squatter areas within the ring road of Kathmandu Valley in Nepal.

II. MATERIALS AND METHODS

Study Area

The study considers the Kathmandu Valley within the ring road which is located in the central part of the country that falls under province no 3. The total surface area of Kathmandu is only 665 square kilometres in the Bagmati zone. It has 3 million of the population in 2010. There are three cities in the valley. These are Kathmandu, Lalitpur and Bhaktapur. There are many squatters' areas in Kathmandu Valley but the following settlements have been selected for this study (Fig.2). Shankhamul, Balkhu, Thapathali and UN Park, Gairigaun, Sinamangal, Jagriti Nagar, Shanti Nagar, Chandani Tola, Prayag marg, and Kalimati dol

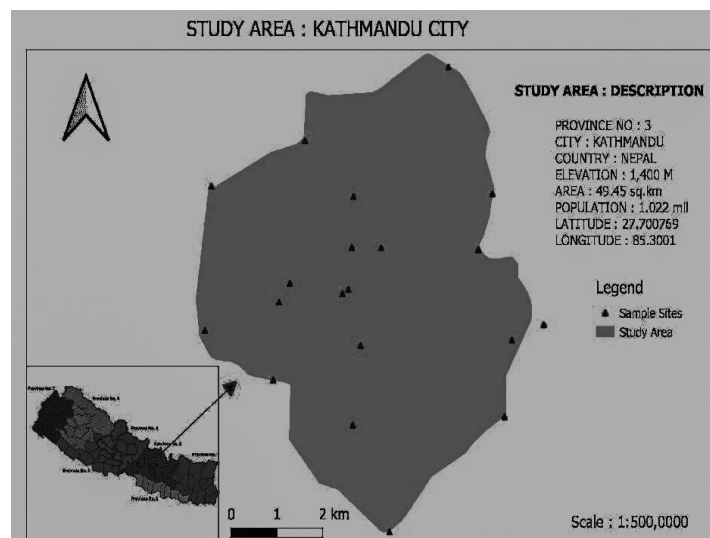


Fig. 1 Map of study area

Sample Size:

The total number of study areas is ten. The total population of the study area is 1749 among them 183 respondents were taken as samples. The size of the sample is calculated by using Slovin's formula: $n = \frac{N}{1 + N(e)^2}$. Where, where n = size of the sample, N = total population of the municipality, e = margin error, total population (N) = 1749. Margin error (e) is taken as 7 %.

Data analysis:

The RII method has been used to analyze the data collected from the field.

Study Period

The research was conducted in the year 2022 in Kathmandu.

Data Collection method:

Field observation, In-depth interviews, focus group Discussion and Questionnaires were the major tools used during the field investigation of this study

III. RESULTS

Profession of the Respondents

The survey indicates (Fig 2) that 61 % of the respondents were involved in business while 25 % of them were students. Similarly, 8% were government service holders, 5% were from the health sector and 1% from the agricultural sector.

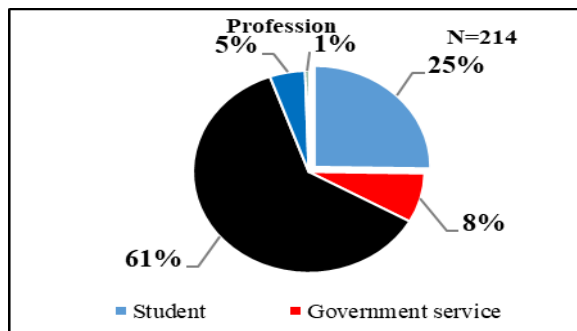


Fig. 2 Profession of Respondents (Field Survey, 2022)

Family size of the respondents

The survey indicates (Fig 3) that 48 % of the respondents had a small size family whereas 42 % were living in a medium size family and 10 % had a large family size.

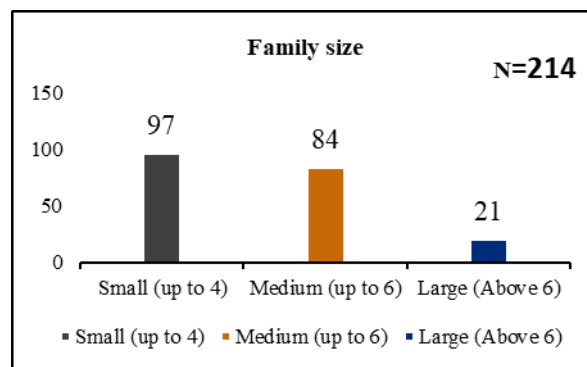


Fig. 3 Family Size of Respondents (Field Survey, 2022)

Income of the respondents

The survey indicates (Fig 4) that 32 % of the respondents' income was between 25000-40000 whereas 31 % of the respondents' income was above 40000. Similarly, 20 % of the respondents' income was between 10000-25000 and 17 % of the respondents' income was below 10000.

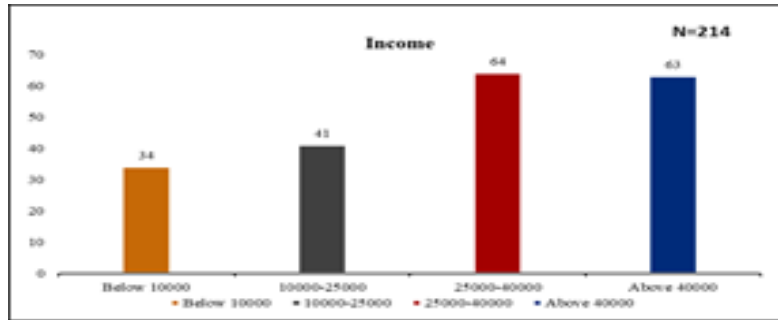


Fig. 4 Income of Respondents (Field Survey, 2022)

Analysis based on problems of solid waste management in squatter areas within ring road of Kathmandu city. There were nineteen options for ranking. The value of Loss of aesthetic beauty and tourism Industry as a problem received the highest rank (RII=0.71). Similarly, people’s attitude and behavior, emission of Greenhouse gases and Flooding/inundation during monsoon also received the highest rank (RII=0.71) whereas a smaller number of Inadequate waste collection and disposal of wastes received the lowest rank (RII=0.67).

All options and their respective value are presented in (Fig 5).



Fig. 5 Analysis to problems caused due to improper solid waste management in squatter area within ring road of Kathmandu valley (Field survey 2022)

Analysis based on causes of Inadequate number of wastes collecting vehicles

There were seven options for ranking. The highest value was for Insufficient budget (RII=0.71) whereas the lowest value was for lack of available landfill site away from the site and less prioritization of solid waste management as well as lack of available landfill site away from the settlement (RII=0.67). The hierarchy of the graph from the highest to lowest for causes of an Inadequate number of wastes collecting vehicles has been arranged as follows in Fig (Fig 6).

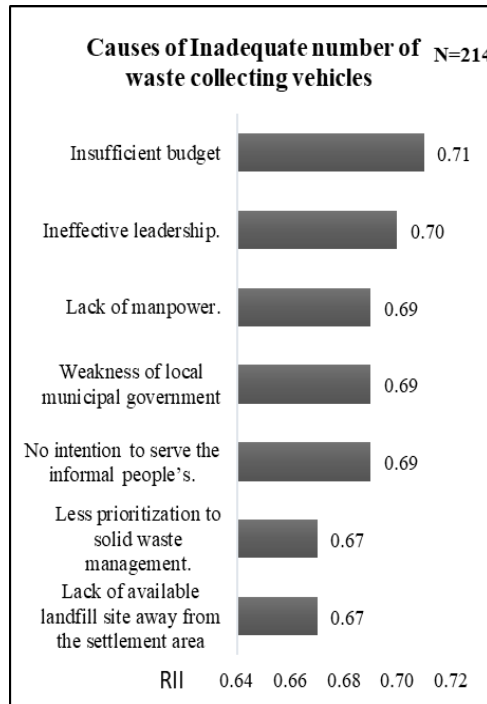


Fig. 6 Analysis to causes of inadequate number of wastes collecting vehicles, (Field survey 2022)

Analysis based on effects of Inadequate number of wastes collecting vehicles

There were seven options for ranking. The options for unable to reach in a squatter area, causing respiratory diseases, leading to air pollution and loss of aesthetic beauty were ranked the same (RII=0.70) whereas the lowest value was for bad smell (RII=0.67). The hierarchy of the graph from the highest to lowest for the effects of Inadequate number of wastes collecting vehicles has been arranged as follow in Fig (Fig 7).

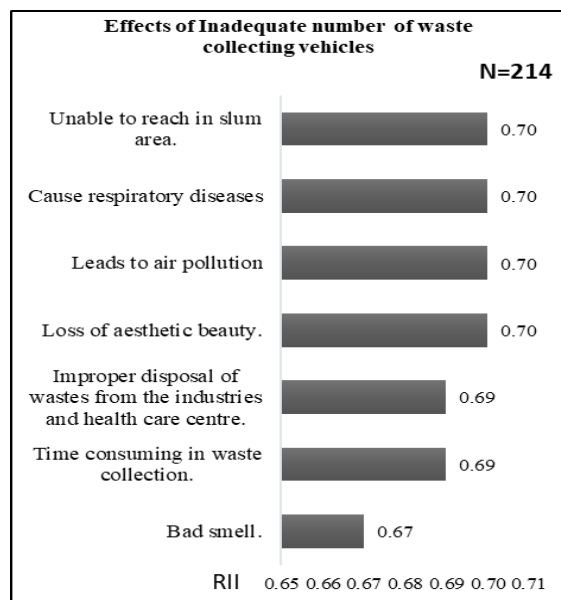


Fig. 7 Analysis to effect by inadequate number of wastes collecting vehicles, (Field survey 2022)

Analysis based on Causes of Loss of aesthetic beauty and tourism Industry

There were five options for ranking. The highest value was for dumping of solid wastes in the streets and the bank of the rivers (RII=0.71) whereas the lowest value was for Inadequate collection and disposal of solid wastes (RII=0.67). The hierarchy of the graph from the highest to lowest for causes of loss of aesthetic beauty has been arranged as follow in Fig (Fig 8).

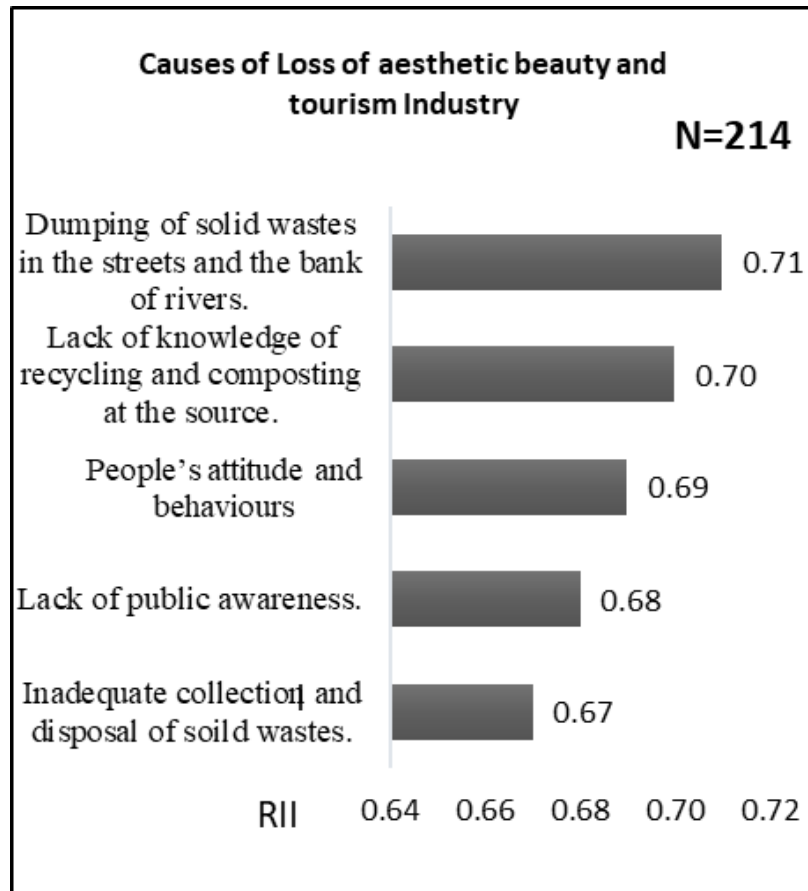


Fig. 8 Analysis to causes of loss of aesthetic beauty and tourism Industry (Field survey 2022)

Analysis based on Effects of Loss of aesthetic beauty and tourism

There were four options for ranking. The highest value was for unpleasant environment (RII=0.71) whereas the lowest value was for decrease in national economy (RII=0.68). The hierarchy of the graph from the highest to lowest for causes of effects of loss of aesthetic beauty has been arranged as follow in Fig (Fig 9).

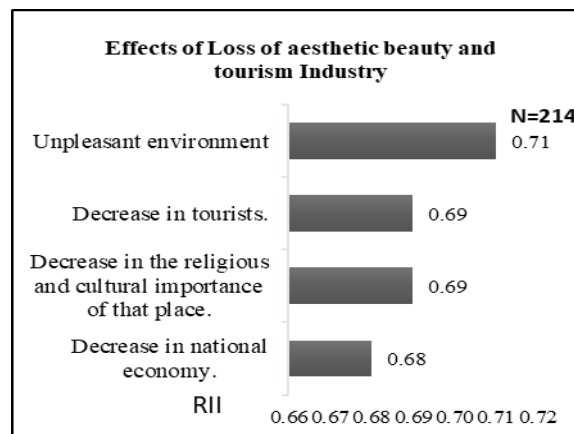


Fig. 9 Analysis to effects of loss of aesthetic beauty and Tourism Industry (Field survey 2022)

Analysis based on effects of Negative impact on the public health.

There were five options for ranking. The highest value was for the option loss of money and as well as unemployment were ranked same (RII=0.69) whereas the lowest value was for the option poverty and effects on livelihood were ranked same as (RII=0.67). The hierarchy of the graph from the highest to lowest for causes of negative impact on the public health has been arranged as follow in Fig (Fig 10)

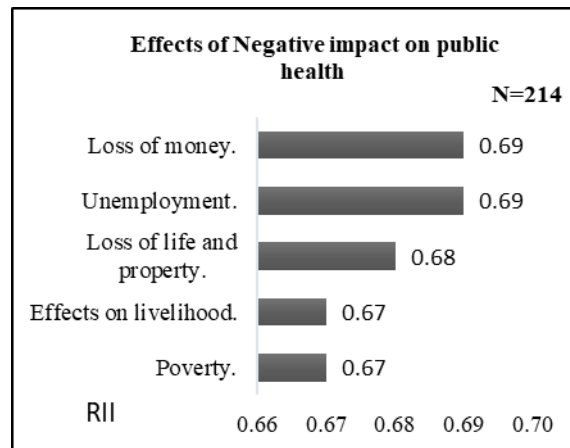


Fig. 10 Analysis to effects of Negative impact on the public health (Field survey 2022)

Analysis based on causes of Negative impact on the public health.

There were nine options for ranking. The highest value was for the option Toxic waste collection by the waste pickers and dumping of solid wastes in the street and in river bank were ranked same (RII=0.71) whereas the lowest value was for clogging of open drains and rivers (RII=0.67). The hierarchy of the graph from the highest to lowest for causes of emission of greenhouse gases has been arranged as follow in Fig (Fig 11).

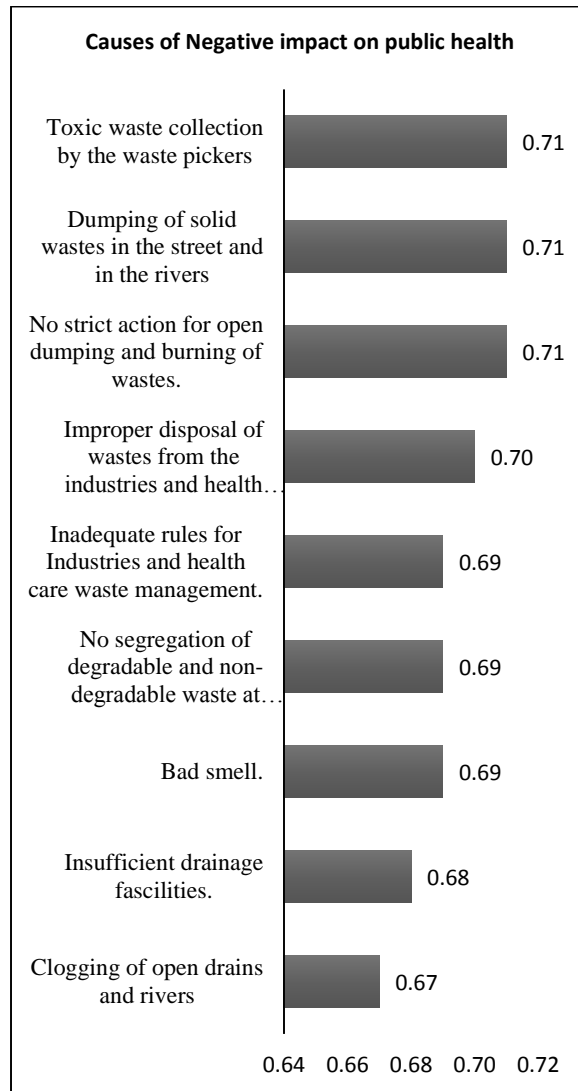


Fig. 11 Analysis to causes of Negative impact on the public health (Field survey 2022)

Analysis based on causes of emission of greenhouse gases

There were four options for ranking. The highest value was for option methane released from the landfill gases as well as excessive use of petroleum products results the value same (RII=0.72) whereas the lowest value was for excessive waste generation (RII=0.70). The hierarchy of the graph from the highest to lowest for causes of emission of greenhouse gases has been arranged as follow in Fig (Fig 12).

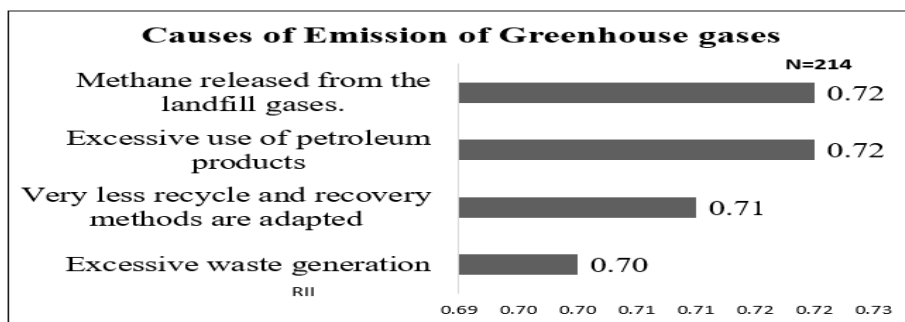


Fig. 12 Analysis to causes of emission of greenhouse gases (Field survey 2022)

Analysis based on effects of emission of greenhouse gases

There were four options for ranking. The highest value was for leads to global warming (RII=0.72) whereas the lowest value was for causes respiratory diseases (RII=0.70). The hierarchy of the graph from the highest to lowest for effects of emission of greenhouse gases has been arranged as follow in Fig (Fig 13).

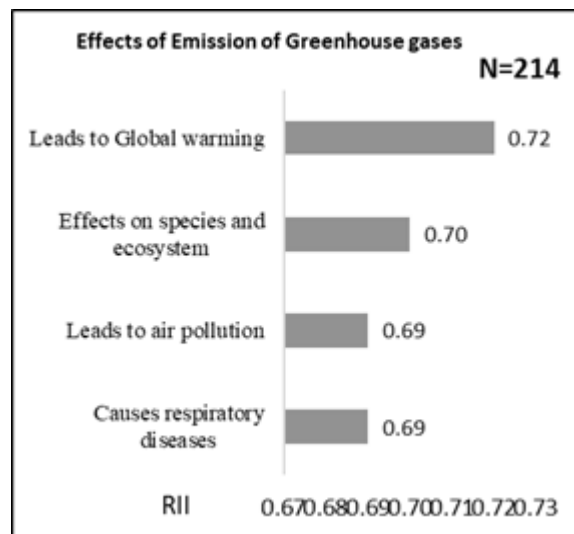
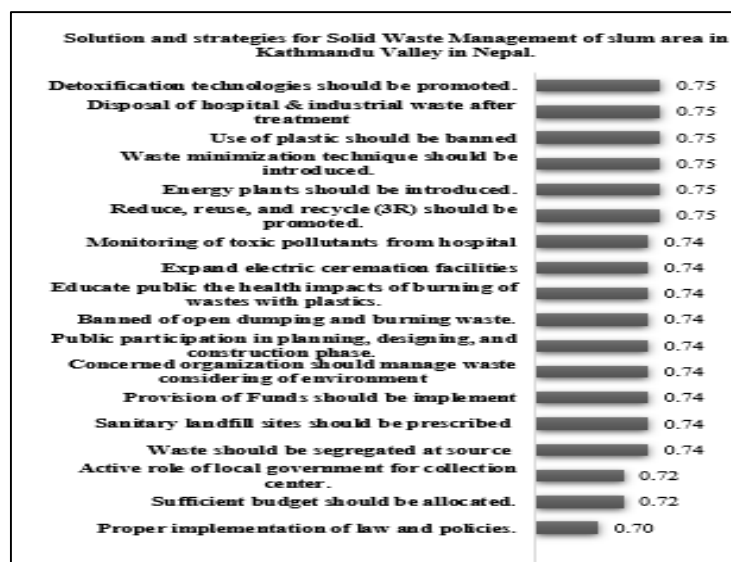


Fig. 13 Analysis to effects of emission of greenhouse gases (Field survey 2022)

Solution and strategies for Solid Waste Management of squatter area within ring road of Kathmandu Valley in Nepal

There were nineteen options for ranking. The highest value was for Demonstration programs should be launched to promote (RII=0.77) whereas the lowest value was for existing laws and policies related to solid waste management (RII=0.70). The hierarchy of the graph from the highest to lowest for appropriate solutions for proper solid waste management has been arranged as follow in Fig (Fig 14).



IV. DISCUSSION

During field visit it was found Among 65 squatter area are located in Kathmandu Metropolitan City. The majority are established along river banks. These squatter communities are often inhabited by permanent residents, with second and even third generations sharing the same shelter. Sewerage in Kathmandu is disposed of in the Bagmati and Vishnu Mati rivers passing through the city. The use of the river for ritual and daily activities. They are at the risk of seasonal landslides and flooding. These settlements contribute (though only partly) to the general degradation of rivers, full of plastic, excrement, sewage and refuse. Uncollected and/or illegally dumped soiled

nappies, food waste, sand, gravel, paper, plastic packaging, metal, and glass contribute to several environmental impacts. Drains clogged with waste cause flooding during rainy seasons. The stagnation of water in waste and food waste items attracts mosquitoes and other insects which breed and spread vector-borne and infectious diseases. In some instances, domestic waste and plastics are burned, which creates smoke that contains carbon monoxide, particulate matter, and nitrogen oxides, all of which are hazardous to human health. The acute respiratory infections and diarrhea are significantly higher in children living in households without regular waste removal services and burning solid waste in the yard. Solid waste is generated faster than any other environmental pollutants and burning of it produces greenhouse gases that contribute to global warming.

The expert in-depth interview with the expert was held and it was found Squatters' area is not reflected on a map, has no address, pays no taxes, does not have official access to infrastructure such as public transportation, roads, water and electricity, does not have official access to formal health and education, cannot get any subsidies and lives outside the law. People living in informal settlements have difficulty in access to infrastructure and services such as water supply, sanitation, electricity, roads and drainage, schools, health facilities, markets, due to illegal. State government should need to recognize that the squatter dwellers and not just beneficiaries of development. Kathmandu City require local solutions. Local authorities need to be empowered with financial and human resources to deliver services and infrastructure to the squatter dwellers in the squatter's area within in ring road. State governments have to develop strategies to prevent the formation of new squatters. These should include access to affordable land, reasonably priced materials, employment opportunities and basic infrastructure and social services. It needs to invest in housing, water, sanitation, energy and urban services, such as garbage disposal. The poor living in squatters' area must reached these services and infrastructure. While expanding the choices regarding the settlement of squatter people's the transportation needs and safety concerns to a city's poorest residents should be priority, which can expand the choices of poor people have regarding where to live and work.

Similarly, focus group discussion was also organized. The beneficiary reported that there was no fixed time on a given day when service provides picked up the waste from their homes. People in poor urban areas like squatters' area still dump in river banks and open spaces in the absence of adequate collection services. Lack of monitoring of door-to-door waste collection service as waste collection is not properly done in some of the areas. There are inadequate financial resources and equipment for waste management has been seen. Hospitals, Factories and industries should be given proper guide lines for solid waste segregation and treatments at the source itself and timely monitoring should be done. Municipalities and non-government agencies should work closely together to increase the level of awareness on proper waste management in squatters' area.

V. CONCLUSION

In squatters. solid waste management practices such as storage and disposal practices were unsatisfactory, and separation and composting were minimally practiced. Solid waste has made a huge impact in Kathmandu Metropolitan City. Based on the findings of the study the conclusion is summarized and presented here under. The major problem caused by these issues are increased in loss of aesthetic beauty and tourism industry, people's attitude and behavior's, emission of Greenhouse gases and Flooding/inundation during monsoon season. Negative impact on public health is caused due to the dumping of solid wastes in streets and on banks of rivers, with no strict action for open dumping and burning of the wastes. The causes of emission of Greenhouse gases are due to methane release from the landfill gases which leads to global warming. The cause of an inadequate number waste-collecting vehicles is the insufficient budget which results unpleasant environment.

REFERENCES

- [1]. M. R. M. and P. C. Hewett, "Urban Poverty and Health in Developing Countries: Household and Neighborhood Effects Author (s): Mark R. Montgomery and Paul C. Hewett Published by: Springer on behalf of the Population Association of America Stable, vol. 42, no. 3, pp. 397–425, 2005.
- [2]. K. Charan, "Munich Personal RePEc Archive Unacknowledged Urbanisation: The New Census Towns of India," no. 41035, 2013.
- [3]. P. Kumar Rai and V. K. Kumra, "Role of Geoinformatics in Urban Planning," J. Sci. Res., vol. 55, pp. 11–24, 2011.
- [4]. A. D. Bank, "Solid Waste Management in Nepal," Abstr. Pap. 7th World Congr. ..., 2005.
- [5]. S. Bakrania, "Urban poverty in Nepal," GSDRC Appl. Knowl. Serv., vol. 2014, pp. 1–13, 2015.
- [6]. R. Shrestha and P. Nepali, "Livelihoods of squatter settlements: analysis from tenure perspective," FIG Peer Rev. J., no. 8536, 2017.
- [7]. P. Sharma, "Chapter 10 Urbanization and Development," Cent. Bur. Stat., Nepal, pp. 375–412, 2003.