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Factors Affecting Adoption of Systematic Household Waste Management, Waste Composting and Homestead Farming in Bharatpur, Janakpur and Pokhara

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ABSTRACT

SOLID Health project of Nepal Development Society (NeDS) aimed at effective household solid waste management through 3R approach in three mega cities: Bharatpur, Janakpur and Pokhara. On which, non-organic wastes were encouraged to reuse, recycle and safe disposal, whereas organic wastes were attempted to manage through composting at household level and utilizing at homestead farming. The program was executed for around two and half years within the year 2021 to 2024. Major program interventions were capacity enhancement programs, practical demonstration and support with resources. Data were collected from 348 project intervention households through structured surveys, complemented by Focus Group Discussions and Key Informant Interviews. The achievement of the projects was comparatively analyzed with baseline information. Rooftop farming was most prevalent in Pokhara (64%), while kitchen gardening was more common in Bharatpur (71%). Overall, 81% of households across the three cities practiced either rooftop farming, kitchen gardening or both. In overall, there was around 69% percentage change in knowledge and attitude of respondents towards waste management, composting and homestead gardening as compared to baseline status. Composting practice at home was increased significantly in all three cities after project intervention, which was increased by 39% in overall. Also, there was significant adoption of reusing and recycling of the non-organic wastes rather than sending all those to municipality vehicle. Socio-demographic factors such as education level, income, and land availability were significant determinants of adoption. Households with higher education levels and larger homestead land areas showed greater likelihood of practicing kitchen gardening and rooftop farming. A combination of land

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availability, education levels, economic factors, age group, gender and type of capacity development support approach appear to be the primary drivers behind the differences in adoption rates between three cities.

Keywords: Household waste, kitchen gardening, rooftop farming, waste composting

INTRODUCTION

Urban households in Nepal are facing increasing challenges in managing solid waste though waste bears opportunity of converting into valuable products supporting environmental and health safety. Existence of dense population in city areas, rapid urbanization, and availability of cheap use & throw non-degradable materials, lack of appropriate mass disposal facilities and delayed adoption of improved technologies are major causes of ineffective solid waste management in big cities of Nepal. While assessing the countries overall waste generation (i.e. around 1 million mt. per year), household wastes shares around 39% followed by business houses (25%), health institutions (10%), educational institutes (10%), industries (9%) and others (7%). As per 2021 census, more than 66% of total households of the country reside in municipalities. Organic (biodegradable) waste is the major part of household waste, which shares more than 65% of waste composition. Also, organic wastes are potential biomass for composting at household level that can support homestead gardening through proper utilization of limited spaces. At present condition, there exist increasing trend of urbanization due to people's migration from rural areas, which seeks reform measures against existing challenges of improved infrastructures and services like drinking water, waste management and sanitation. Integration of household waste management practices with rooftop farming and kitchen gardening has been promoted as a sustainable approach to minimize the negative impacts associated with solid waste management.

The SOLID-HEALTH project, titled "Improving public health and environmental health in Nepal through appropriate solid waste management," of Nepal Development Society (NeDS) aimed at improving household waste management undertaking 3R (Reduce, Reuse and Recycle) approach. Out of three major objectives, objective 1 focused on reducing household wastes through promoting organic waste composting, encourage homestead farming along with capacity strengthening for non-organic waste reuse and recycle. The program was executed for around two and half years within the year 2021 to 2024. This program intervention was implemented in three mega cities Bharatpur, Janakpur, and Pokhara. The project achieved some significant

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changes in adoption of systematic household waste management through organic waste reduction at source by composting and utilizing at homestead farming. Key project interventions were capacity enhancement programs, practical demonstration and support with resources. Support was focused on waste segregation, composting practices, and the adoption of homestead farming (kitchen gardening and roof top farming) techniques. For effective training delivery, Training of Trainers (ToT) was provided to selected community members, who delivered orientation to other members to expand the knowledge and skill. In addition, project provided material support (compost bin/chamber) and home based guidance on reuse and recycle of non-organic waste timely.

MATERIALS AND METHODS

This study examines the factors influencing adoption of improved household waste management, composting and compost utilization at homestead greenery. The project was evaluated during year 2024 to measure the impacts against baseline status. Though there were multiple outcomes against all project objectives, this research paper is confined only for objective 1 outcome. The findings are drawn from the quantitative and qualitative analysis of the project's impact assessment research. The outcome of this research is evidence-based findings from the project impact assessment survey of the SOLID-HEALTH Project. Standardized questionnaires were used for the quantitative survey at household level. Key Informant Interviews (KIIs) and Focus Group Discussions (FGDs) with various stakeholder groups were conducted along with interview guides. Purposive Sample survey was employed for the household survey, in which the sample size of 348 was surveyed across Bharatpur, Pokhara, and Janakpur. Purposive sampling was used to identify participants for FGDs.

Table 1. Total number of households surveyed in the study areas

Metro/Sub-Metro City	Total No. of HHs surveyed
Bharatpur	108
Janakpur	118
Pokhara	122
Total	**348**

The data were statistically analyzed to identify the key determinants that encourage or hinder households from implementing organized waste segregation, composting of organic waste, and the integration of homestead farming include awareness, knowledge, access to resources, and socio-economic conditions. The level of changes

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in response to such factors and intercity differences are discussed in this research article. The OECD DAC method was applied to measure the level of changes in knowledge, behavior and practice. Based on frequency of responses to different strengths of changes, percentage analysis was made to those parameters.

RESULTS AND DISCUSSION

Comparison of adoption rates in three cities

Objective 1 of the Solid Health project focused on primary management of solid waste at household level and successive utilization of compost from organic waste home-based gardening. The project interventions like capacity and skill enhancement approaches, practical demonstration and material support have put significant impact in various aspects, which are discussed hereafter.

Change in Knowledge and Attitude

Percentage change in **knowledge and attitude** of respondents towards waste management before and after the training (ToT and Orientation on waste composting, kitchen gardening and roof top farming) is around 69% (overall). As per the response, the most percentage change observed was in Janakpur followed by Pokhara. There was found positive impact of program with such changes seeking continuation of the project to gain subject matter specific changes in the future.

Table 2. Percentage change in knowledge and attitude of respondents

City	Average % change in knowledge and attitude	N
Bharatpur	55.12	108
Janakpur	79.97	118
Pokhara	70.07	122
Total	**68.79**	**348**

Source: Field Survey, 2024

State of adoption of solid waste management practices

While reviewing the data analysis outcomes, biodegradable waste management has become more systematic after project interventions. In overall, 80% respondents are composting organic wastes at home. Though compost bins are more used in Janakpur,

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composting activates highly exist in Bharatpur and Pokhara. As compared to baseline there is significant change in adoption of management practices for both degradable and non-degradable waste management (Table 3). Non-degradable waste was found to be more re-used and recycled (sale to collectors/recycling units). These practices were more adopted in Bharatpur and Pokhara. In Janakpur, the project improved the status at higher proportion as compared to baseline status.

Table 3. Practices for management of bi-degradable waste

Management of biodegradable waste					
Option	Result from	Bharatpur	Janakpur	Pokhara	Grand Total
Composting- pit, pile, ring, bin)	After project	82%	73%	84%	80%
	Baseline	63%	7%	53%	41%
Management of Non-biodegradable waste					
Sending to Municipality Waste Vehicle	After project	81%	67%	89%	79%
	Baseline	95%	89%	93%	92%
Reuse	After project	82%	5%	94%	60%
	baseline	10%	2%	15%	9%
Recycle	After project	65%	0%	56%	40%
	Baseline	3.50%	1.30%	1.80%	2.20%

Source: Field Survey, 2024

Adoption of kitchen gardening and roof top farming practices

While reviewing the increment percentage of HHs adopting kitchen gardens and roof top farming, there is slight increment (as compared to baseline status) with roof top farming. The increment is homogenous covering all cities. Table 3 illustrates the percentage of adoption of roof top farming, kitchen garden and either of both practices.

Table 4 indicates that in overall, 81 percent respondents practiced either roof top farming or kitchen gardening or both. Of them, 57% practiced sole kitchen gardening, which is highest in Bharatpur followed by Pokhara and Janakpur. In Pokhara, 94% practice either kitchen gardening or rooftop farming, showing the highest adoption rate among the three cities.

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Table 4. Percentage of HHs practicing rooftop farming, kitchen gardening or both

Assessment	City			Total
	Bharatpur	Janakpur	Pokhara	
After project execution	34%	39%	64%	46%
Baseline	30%	26%	63%	41%
Percentage of practice (kitchen garden, rooftop farming or both): post project				
Particular	City			Total
	Bharatpur	Janakpur	Pokhara	
Either of one or both (Kitchen garden or roof top)	82%	66%	94%	81%
Kitchen Garden	71%	42%	58%	57%

Source: Field Survey, 2024

Roll model households

There were role model households in all cities in terms of best practice of solid waste management, composting and homestead gardening. Pokhara had highest number of role model households (20) which were successful to adopt and implement the best practices after participating in the Solid Health program of NeDS. Also, an impressive number of participants (14) were produced in Janakpur followed by Bharatpur (10). Those households were successful examples, from which other community members could gain knowledge and empowerment for household level sanitation and greenery maintenance.

Factors affecting adoption rates

A fundamental prerequisite for adoption is awareness and understanding of the new practice. If individuals are unaware of a practice composting or don't understand its benefits of reduced waste, improved soil, they are unlikely to adopt it. Training and support programs were directly interrelated with these factors. Also, there are some non-project intervention factors which resulted in creating variations in adoption rates in three cities, which have been discussed hereunder.

Land availability and ownership

Pokhara respondents had the least homestead land areas, which may have driven higher adoption of rooftop farming (64%) compared to other cities. Janakpur

respondents owned smaller areas of land due to the dense urban setting, which could explain their lower overall adoption rate (66%) for kitchen gardening or rooftop farming. Bharatpur respondents had the highest land ownership, which may have facilitated higher adoption of kitchen gardening (71%).

Education and income

Bharatpur had a higher rate of literacy and education, with more respondents having higher secondary and bachelor's level education. Janakpur had a lower overall education level, with more respondents having only basic literacy or lower secondary education. Education level was found to be strongly associated with adoption of rooftop farming and kitchen gardening. Households with higher secondary or above education were more likely to adopt sustainable roof top farming practices. While analyzing the average comparison of yearly income values in three cities, there was significant difference found with Cities. Following is the F test result (mean comparison) and the analytical database:

Table 5. Mean comparison of the yearly gross income of respondents groups

Interaction	Degree of freedom	F value	Significance (95%)
Annual income * City	2	38.089	.000
City	Mean annual income (NPR)	N	Std. Deviation
Bharatpur	597685	108	341485
Janakpur	561305	118	580388
Pokhara	1062049	122	516525
Total	748144	348	544178

Source: Field Survey, 2024

There is higher level of significant difference (P=<0.05), the table has shown that average annual income is higher (almost at double level) in Pokhara than that of Bharatpur and Janakpur, which are not significantly different. The survey found that higher incomes enabled greater investment in sustainable homestead farming and safe roof top farming practices.

Gender and age group

The age groups of 35-54 range were the utmost participants' group in the program. In each city, more than 85% practitioners were female members. Engagement of such age group indicated that mature female members were active in the project.

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Table 6. Age group and gender of respondents

Particulars	Labels	Bharatpur %	Janakpur %	Pokhara %
Age group (Yr)	35-44	41	39	27
	45-54	34	16	40
Gender	Female	86%	99%	91%
	Male	14%	1%	9%

Source: Field Survey 2024

Project's capacity enhancement approach

Project's interventions had mutual connections and benefits such as: composting reduced waste volume and farming/gardening supported degradable waste management along with improvement in knowledge and skill. As per the respondents, there were three major changes due to composting and homestead farming, which were: "Appropriate waste management" followed by "Increase in knowledge and skill" and "Increased productivity of crops". During qualitative survey, ToT recipient members and some active respondents mentioned that they had increased productivity of crops from kitchen garden or roof top farming. In overall, 51 respondents realized increased crop productivity due to technological improvement (Table 7). Hence ToT approach was an effective activity within the project interventions.

Table 7. Changes due to training on composting and homestead farming

City	Benefits/achievements from training on rooftop farming, composting, bio pesticides and others		
	Increment in knowledge and skills	Appropriate waste management)	Increased productivity of crops)
Bharatpur	88	75	8
Janakpur	56	112	2
Pokhara	119	104	41
Total	263	291	51

Source: Field Survey, 2024

CONCLUSION

The Solid Health project of NeDS boosted systematic household waste management along with increased adoption of waste segregation, composting and homestead gardening in three mega cities of Nepal. It has also positively contributed for increased food security and health & environmental safety. The findings and recommendations

provide a roadmap for improving and sustaining adoption in the future. The adoption of improved waste management and homestead food production practices was influenced by multiple factors. Education, income, and land availability are the primary factors influencing adoption of improved household waste management, rooftop farming, and kitchen gardening. Project interventions that combine technical training, resource provision, and awareness rising were effective in overcoming structural barriers.

For long-term sustainability, municipal governments should integrate these practices into local waste management policies, provide continuous support for training, and incentivize households to adopt waste-to-resource approaches.

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