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Posted Date: 24 June 2024

doi: 10.20944/preprints202406.1657.v1

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Article

Effectiveness of Social Technical Assistance (STA) Program for Vulnerable Beneficiaries: Evidence from Nepal's Post-Earthquake Reconstruction

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Abstract: This research assesses the effectiveness of the Socio-Technical Assistance (STA) program combined with Owner-Driven Housing Reconstruction for rural private housing recovery after Nepal's 2015 earthquake, particularly targeting vulnerable households. Through a quantitative 304-questionnaire survey, the study reveals that 96% of households credited STA activities for accelerating reconstruction, with 95% acknowledging its significance and 78% emphasizing its necessity. Notably, 89% expressed dependency on STA for reconstruction, and 85% believed it heightened disaster risk reduction awareness. In conclusion, the study establishes that STA activities significantly contributed to the successful reconstruction of houses for vulnerable households, addressing critical aspects such as financial support, technical assistance, housing accessibility, earthquake-resilient construction, improved livelihoods, and safety enhancements. The field study presents crucial recommendations to enhance the effectiveness of Socio-Technical Assistance (STA) activities in post-earthquake rural private housing reconstruction. Emphasizing the need for tailored, demand-driven interventions, the study cautions against relying solely on an Owner-driven Reconstruction model, challenging the one-size-fits-all strategy. The study proposes integrating tailored interventions into overarching recovery strategies, advocating for coordinated efforts to enhance Disaster Risk Reduction (DRR) awareness and to cultivate resilient communities in particularly vulnerable households aligned with United Nations Sustainable Development Goal 11, which focuses on sustainable cities and communities. This research aims to enhance the literature on post-disaster humanitarian shelter and settlement by emphasizing the significance of inclusive and comprehensive approaches to recovery and reconstruction.

Keywords: Effectiveness; Gorkha earthquake 2015; Owner-driven reconstruction; Private Housing Reconstruction; Vulnerable earthquake beneficiaries; Socio-Technical Assistance

1. Introduction

Disasters disproportionately affect developing countries, with the poor and marginalized people bearing the brunt (Hillier & Nightingale, 2013). The capacity of individuals to cope or recover following a disaster is contingent upon an intricate interplay of factors, including abilities, class, gender, social networks, income, land and other assets, information access, legal entitlements, government policies, and mechanisms, among other considerations. Disparities in physical and financial capabilities, along with uneven access to resources, can render specific groups more susceptible than others, potentially intensifying social divisions and conflicts (Hyndman & Hyndman, 2011; Wisner et al., 2014; De Juan et al., 2020). Disasters exacerbate coping and recovery capacities, leading to heightened vulnerabilities (Bates & Peacock, 1989; Hyndman & Hyndman, 2011; He et al., 2018). To assist vulnerable beneficiaries overlooked in post-earthquake, governmental and non-governmental organisations introduced Socio-Technical assistance (STA) in conjunction with Owner-driven reconstruction (ODR) in Nepal.

Nepal is ranked as the 20th most disaster-prone country globally and holds the 4th, 11th, and 20th positions in various climate change vulnerability categories (MoHA, 2017; ADRC, 2020). The 7.8 magnitude earthquake of April 25, 2015, led to more than 8,790 fatalities and over 22,300 injuries and

incurred approximately \$7 billion in damages, with housing (755,000 houses destroyed or damaged) contributing to nearly half of the total damages (Global Shelter Cluster, 2019). Nepal's post-earthquake reconstruction is considered the world's largest owner-driven housing reconstruction (ODR) effort, with over 753,104 beneficiaries (93%) rebuilding their houses (NRA, 2021). In response, the Government of Nepal (GoN) embraced the Owner-Driven reconstruction (ODR) approach in accordance with the 'Build Back Better' approach outlined in the Sendai Framework (UNDRR, 2015-30) based on the successful international implementation, considered as a 'global default reconstruction strategy' in low-income countries (Karunasena & Rameezdeen, 2010a; Lam, 2022). ODR emphasizes a process-driven housing reconstruction, fostering beneficiary involvement, promoting self-reliance, livelihood exploration, and improving quality of life, resilience, and connectivity. In contrast, a product-driven approach focusing solely on house delivery results in a passive dependency (UNDP, 2021b). There is a growing need for empirical evidence, as shelter and settlement interventions remain an inadequately explored facet of the humanitarian response (Twigg, 2006; Peacock et al., 2007; Peacock et al., 2018) and to explore impacts (Ganapati & Mukherji, 2014).

Against this backdrop, the paper examines the effectiveness of the Socio-Technical Assistance (STA) program combined with Owner-driven reconstruction, especially for vulnerable households, also synonyms used in this paper as 'beneficiaries' left behind in the large-scale private housing reconstruction. The research highlights the positive impact of well-implemented STA activities in providing crucial relief to vulnerable earthquake beneficiaries and leading their recovery efforts in rural housing reconstruction. It stresses the necessity of socio-technical facilitation mechanisms at different levels.

2. Literature Review and Research Gaps

Numerous studies focus on the successful international implementation guidelines and models for the Owner-driven reconstruction (ODR) approach (Barenstein et al., 2010; IFRC, 2010; Build Change, 2014; Tafti & Tomlinson, 2015; Vahanvati & Beza, 2017a; UNDP, 2021b; Hunnarshala Foundation, n.d.) as well as framework (Barenstein, 2006a; 2006b; Bilau et al., 2015; Vahanvati & Beza, 2015; Ade Bilau & Witt, 2016; Vahanvati & Mulligan, 2017; Bilau et al., 2018; Vahanvati, 2018), satisfaction (Bhusal & Bhattarai, 2023), evaluation of ODR (Lam, 2022), comparative study of donor vs owner-driven reconstruction approach (Karunasena & Rameezdeen, 2010a; Andrew et al., 2013), limitations of ODR (Taheri Tafti, 2012); there is a notable dearth of research specifically assessing the effectiveness of STA interventions on vulnerable beneficiaries. Existing studies primarily explore specific programs, and few address the effectiveness of STA targeting vulnerable beneficiaries eight years after the earthquake. In our earlier study, we had observed the heterogeneity of households due to several background factors, including gender, age, education, religion, ethnicity, and vulnerability, whether satisfaction rates differed across the factors have been tested in our previous study (Bhusal & Bhattarai, 2023).

Previous research highlights challenges in Nepal's reconstruction, such as not being able to build houses even after receiving grants due to the government's inefficiency in delivering funding and services to affected beneficiaries and the lack of coordination among NGOs (Lam et al., 2017), geographical challenges (Bothara et al., 2016; Sharma et al., 2018), vulnerability and social inequality (Jackson et al., 2016; Eichenauer et al., 2020; Rawal et al., 2021), issue of INGO's top-down policy implementation (Sanderson & Ramalingam, 2015) and corruption (Dhungana & Cornish, 2021). Despite implementing the ODR model, vulnerable beneficiaries were evidenced from this study to be '*left behind*' through the large-scale private housing reconstruction.

Limited studies have assessed the effectiveness of STA interventions on project-specific program interventions in Nepal's post-earthquake context, evaluating specific projects outcomes (Dhungel et al., 2019; Gouli et al., 2019; Karki et al., 2020b; Lamsal et al., 2020; Manindra Malla, 2020; NSET, 2023; Hunnarshala Foundation, n.d.), inclusion of poor and vulnerable (Rawal et al., 2021), approaches to build back better (JICA, 2019a; 2019b; Nagami et al., 2021), community mobilization program (JICA, 2019a), Socio-Technical assistance (The World Bank, 2020-2021), Socio-Technical Facilitation (UNDP,

2019; 2021a). Therefore, there is a need for an independent research study to assess the effectiveness of targeting vulnerable beneficiaries even eight years after the earthquake.

The lessons from the 2004 South Asian tsunami underscore the importance of aligning aid with actual needs and ensuring long-term sustainability (Torrente, 2013). However, research is scarce on the perspectives of 'bottom-up' or aid recipients, hindering a comprehensive understanding and enhancement of aid quality (Ramalingam et al., 2009; Sandvik, 2017). Marginalized individuals often struggle to advocate for themselves, posing challenges for humanitarian organizations to address their needs effectively (Torrente, 2013) and ensure aid reaches the intended target group. Consequently, there is a need for renewed guidelines and criteria, particularly for the most vulnerable (Clay et al., 1999).

An in-depth examination of specific cases is essential to illustrate how interventions lead to distinct evidence to assess the prompt delivery of aid and its effectiveness in bringing about intended improvements in recipients' lives (Proudlock et al., 2009). Moreover, it is crucial to generate reliable evidence to assess the prompt delivery of aid, its effectiveness in bringing about intended improvements in recipient's lives (Puri et al., 2014; Maynard et al., 2017), and its alignment with the humanitarian assistance context.

3. Critical Evaluation of Owner-Driven Reconstruction (ODR)

Table 1 presents an overview of the merits and drawbacks of the ODR model, recognized as a 'default strategy' in low-income countries and implemented in various post-disaster contexts. These include Pakistan, Sri Lanka, Thailand, Indonesia, India (Gujarat, Tamil Nadu, and Bihar), and Haiti.

Table 1. Summary of Critical analysis of ODR cases.

1. Gujarat Earthquake 2001 (6.1 magnitude):			
Number of Deaths	No. of Destroyed houses	Housing Grants	Rebuild Progress
20,000	880,000	INR 40,000-90,000 (USD 570 to 1300) in 2 tranches	2 years completed

Strength

- Recognized most successful ODR practice, achieving reconstruction completion in two years,(rebuilt 200,000 houses and repaired 900,000 houses), described as the world's largest and fastest housing reconstruction program (Price & Bhatt, 2009)
- Acknowledged as good ODR practice attributed to the performance of the reconstruction authority, NGOs, mason training, and community participation. Received the 2003 UN Sasakawa Award for excellent reconstruction managements (IFRC, 2010; Barenstein, 2012) .
- Over 94.5% of household beneficiaries expressed satisfaction with the reconstruction, reporting no faults (Barenstein, 2006a).
- ODR initiatives were identified as the most cost-effective, fastest and satisfactory approach for beneficiaries (Ratnayake & Rameezdeen, 2008).

Weakness

- Reconstruction programs often overlook the evolving needs and requirements of beneficiaries, rendering newly constructed facilities potentially obsolete from the completion day (Barakat, 2003; Ratnayake & Rameezdeen, 2008).
- ODR model tends to prioritize resilience reduction rather than *addressing vulnerability and pre-existing vulnerability issues for incapable individuals* (Barenstein & Iyengar,2010; GoI and NDMA,2011(Barakat, 2003; Alam, 2010). The evolution of ODR from top-down government to decentralized governance leaves gaps in addressing grassroots issues (Rumbach,2016).

2. Sri Lanka Tsunami 2004 (9.1 magnitude):

Number of Deaths	No. of Destroyed houses	Housing Grants	Rebuild Progress
35,000	100,000-120,858	Sri Lankan Rupees 250,000 (USD 2,1000 in 4 tranches)	3 years completed (77%)

Strength

- Embraced after the 2001 Gujarat earthquake, ODR proved successful compared to donor-driven programs in terms of construction time, reconstruction quality ,and satisfaction levels (Ratnasooriya et al., 2007; Ratnayake & Rameezdeen, 2008).

Weakness

- ODR housing reconstruction program yielded mixed outcomes. Key issues included centralized governance, lack of experience overseeing extensive reconstruction, poor capacity of the Sri Lankan government, objections to the proposed no-built buffer zone and shortages of materials and labor contributing to inflating in the construction sector (Ingirige et al., 2008).
 - Evidence suggests that a centralized reconstruction program could have been more efficient for implementing the ODR program. Therefore, decentralized governance is recommended for efficient housing for efficient housing reconstruction in resource-poor countries.
-

3. Indonesia's Earthquake of 2004 (8.9 magnitude):

Number of Deaths	No. of Destroyed houses	Housing Grants	Rebuild Progress
220,000	139,000	US\$ 3,000 (Full reconstruction) US\$ 1,000 (renovation of damaged house)	8 years

Strength

- Both Owner-driven and donor-driven housing reconstruction models were implemented (Wegelin, 2006; Ratnayake & Rameezdeen, 2008).
- ODR demonstrated success over the donor-driven housing reconstruction model(Ratnayake & Rameezdeen, 2008)

Weakness

- Challenges include a scarcity of human resources, bureaucratic and institutional issues, logistical concerns, and a lack of coordination among governmental and NGOs, compounded by limited road accessibility Ophiyandri et al. (2010).
 - Involvement of humanitarian organizations lacking relevant experience in housing reconstruction led to program failures, halts, drops or stops, with poor coordination among *housing providers and target beneficiaries* (Ophiyandri et al., 2010).
 - Major issues identified encompassed construction quality, *dissatisfaction among beneficiaries due to unmet needs*, limited community-level participation ,and accountability concerns (Ophiyandri et al., 2010).
-

4. Pakistan Earthquake 2005 (7.6 magnitude):

Number of Deaths	No. of Destroyed houses	Housing Grants	Rebuild Progress
73,000	463,000	Pakistani Rupees 175,000 (USD 2,916) in 3 tranches	3.5 years (74.4%)

Strength

- Acknowledged successful ODR, notable for effectively integrating traditional architectural techniques into modern earthquake-resistant house design. The program achieved socio-technical alignment by adopting construction technology that matches the needs and preferences of beneficiaries (IFRC, 2010; Jha & Duyne, 2010).
- Within a month of the earthquake, the Pakistan government established the Earthquake Reconstruction and Rehabilitation Authority (ERRA) (ERRA, 2009; van Leersum & Arora, 2011).
- Decentralized authority involving local government units actively participated in community consultation workshops, overcoming challenges of over-centralized large-scale reconstruction that slowed the reconstruction pace.

Weakness

- Highlighted reconstruction challenges in the context of Pakistan, including issues of inaccessibility, lack of preparedness, loss of faith, building construction processes, and scarcity of manpower (Mumtaz et al., 2008).
- Challenges encompassed a knowledge gap among the workforce regarding earthquake-resilient technology, insufficient infrastructure for reconstruction, limited options for rural reconstruction, lack of awareness, techno-legal regime, and restricted access to information.
- A significant number of people were economically disadvantaged and unable to afford modern materials, contributing to socio-cultural issues (Mumtaz et al., 2008).

5. Bihar Flooding 2008:

Number of Deaths	No. of Destroyed houses	Housing Grants	Reb
239	340,742	Indian Rupees 55,000 (USD 1200), Plus Rs 2,300 (USD 50) & Rs 5000 (USD 100) in 3 tranches for solar	Slow

Strength

- ODR implemented as the housing reconstruction strategy, providing extensive support for local masons and artisans. As a result, most residents expressed satisfaction with the participatory process, hazard-safety considerations, construction quality, and the low maintenance of their rebuilt houses (Vahanvati & Beza, 2015; Vahanvati & Beza, 2017b; Gangwar & Thakur, 2018).
- An Owner-Driven Reconstruction Collaborative (ODRC), a multi-stakeholder 27 organizations, including National Disaster Management Authority, UNDP, and a network of Indian development agencies, and institutions with expertise in community-led post-disaster reconstruction, was formed (Vahanvati & Beza, 2015).

Weakness

- ODRC withdrew after project completion without an effective handover to the state government.
 - Bihar's reconstruction program after 2011 was deemed unsuccessful, primarily attributed to insufficient *social mobilization efforts* to initiate reconstruction work (The World Bank, 2015).
-

6.Haiti Earthquake of 2010: (7.0 magnitude)

Number of Deaths	No. of Destroyed houses	Housing Grants
316,000	300,000	US\$ 500 Yearly Rental Cost transferred to landlord. US\$ 2000-2,800 for Transitional Shelter US\$ 3,500-4,500 for permanent house* varied per agencies support

Strength

- A community-based owner-driven model was piloted, and the reconstruction project was found to be highly effective in reducing disaster vulnerability (Ahmed, 2017a; World Bank Group, 2019) and ODR can introduce disadvantaged segments to the Banking sector (Build Change, 2014).

Weakness

- Only 5,200 permanent houses were built within two years, and the provided funds of USD 3500 were observed to be insufficient to complete the owner-driven reconstruction process (Ahmed, 2017b).
- The housing reconstruction process was not directly led by the government, with heavy reliance on external agencies and a lack of coordination among them (Ahmed, 2017b).
- The transition from post-disaster reconstruction to long-term socio-economic sustainable development was identified as a weak area for humanitarian agencies (Ahmed, 2017b).

Source: (1.Barenstein, 2006b; Barenstein et al., 2010),(Ratnasooriya et al., 2007; Ratnayake & Rameezdeen, 2008; Hidellage & Usoof, 2010; Jha, 2010; 4.Quzai, 2010; 2.Arunatilake, 2018),(3.Wegelin, 2006; The World Bank, 2012),(4.Jha, 2010; Quzai, 2010),(5.Vahanvati & Beza, 2015; Vahanvati & Mulligan, 2017; Gangwar & Thakur, 2018; Vahanvati, 2018),(6.Shelter Projects, 2010; DesRoches et al., 2011; Build Change, 2014; Charles, 2020; Lam, 2022).

The analysis above Table 1 sheds light on the limitations of the ODR model. While ODR evaluations often report positive outcomes, experiences from disasters like the Gujarat earthquake, Tamil Nadu, and Haiti's recovery highlight the limited universal effectiveness of the informally applied ODR (Barenstein, 2006a; Barenstein et al., 2010). Adapting program approaches to be 'demand-driven', considering regional variations, is crucial, recognising that ODR cannot provide a 'one-size-fits-all' solution for post-disaster housing challenges. Concerns arise about the evolving nature of ODR, aiming to 'build back better' with high building standards and social-technical community support, potentially proving insufficient in extensive reconstruction projects (Hidellage & Usoof, 2010).

Existing research underscores the benefits of the ODR model based on labour availability and straightforward housing designs (Lyons, 2009). Challenges extend beyond housing investment, encompassing housing governance and the procurement process (Schilderman, 2004). However, this study indicates that vulnerable beneficiaries need assistance to lead the reconstruction process independently. Furthermore, the above analysis reveals limitations in the ODR approach, with scant evidence from a vulnerable household perspective. Studies emphasize unsuccessful reconstruction, citing *insufficient social mobilization* (The World Bank, 2015) and lack of evidence for support and program effectiveness from the 'user-end'. These studies underscore the necessity for a distinct, targeted approach for the most vulnerable, drawing lessons from Nepal's ODR-STA intervention (Caritas, 2019; Dhungel et al., 2019; Gouli et al., 2019; JICA, 2019a; Karki et al., 2020b; Manindra Malla, 2020; The World Bank, 2020-2021; Adhikari et al., 2021; NSET, 2021; Rawal et al., 2021).

4. Conceptual Framework of This Study

This study aims to assess the effectiveness of the 'demand-driven' STA program in rural private housing reconstruction settings through a quantitative survey of 304 vulnerable beneficiaries. The conceptual framework given below illustrates the causal relations between independent variables

(STA Activities: seven activities) and dependent variables in program outcomes, focusing on the user-end's perspectives of vulnerable beneficiaries.

Dependent Variables:

The study examined the outcomes of Social Technical Assistance (STA) interventions in supporting vulnerable beneficiaries in private housing reconstruction as depicted in the above conceptual framework (Fig 2). Participants were surveyed on various aspects, including their ability to construct houses with or without STA support, the satisfaction of needs in newly reconstructed houses, the effectiveness of financial and technical assistance, access to financial grants from Banks and Financial Institutions (BFIs), the acceleration of reconstruction facilitated by STA, awareness of disaster risk reduction (DRR), and the perceived need for STA among vulnerable categories. The study analysed the findings of both constructs – STA activities (Independent variable) and outcomes as (Dependent variable) in measuring Effectiveness STA activities.

Independent Causal Factors

These can be enumerated as follows:

- I. Door-to-door technical Assistance, Demo-Reconstruction, Helpdesk & Technical Resource Centre, Community Reconstruction Committee, Community/Orientation, Short Training for Masons, and On-Job Training for Masons.
 - Positively influence Ability to Build a House and reconstruction skills with STA
 - Contributes to the STA Expedited Reconstruction
- II. STA Expedited Reconstruction:
 - Positively affects Newly Reconstructed House Met Need.
- III. STA Expedited Reconstruction, Effectiveness of Financial Assistance, and Effectiveness of Technical Assistance:
 - Influence Access to Financial Grants from Bank & Financial Institutions.
- IV. Awareness of Disaster Risk Reduction (DRR):
 - Influenced by Community Reconstruction Committee, Helpdesk & Technical Resource Centre, and Training.
- V. Need of STA for Vulnerable Categories and Importance of STA Program Activities:
 - Influence Effectiveness of STA Program Activities.

The study challenges the assumption that owner-driven reconstruction (ODR) or 'self-recovery' is universally applicable, particularly in vulnerable contexts, as suggested by previous literature (Barenstein, 2006a; Hidellage & Usoof, 2010; Jha, 2010; Karunasena & Rameezdeen, 2010b; Barenstein, 2012; Andrew et al., 2013; Vahanvati & Beza, 2015; Maynard et al., 2017; Lam, 2022).

There is a significant gap between project implementation and completion, often due to terminated projects or achievement-focused outcomes, neglecting of future program dynamics and sustainability. Assistance for disaster-affected individuals often needs more timelines, adequacy, fairness, and predictability. The above conceptual framework, summarized in Figure 2, delineates the logical sequence of the seven Independent Variable STA activities that culminate in the Dependent Variable for desired effectiveness in the lives of vulnerable beneficiaries. The detailed operational definition of these measurement variables is as illustrated in Figure 2.

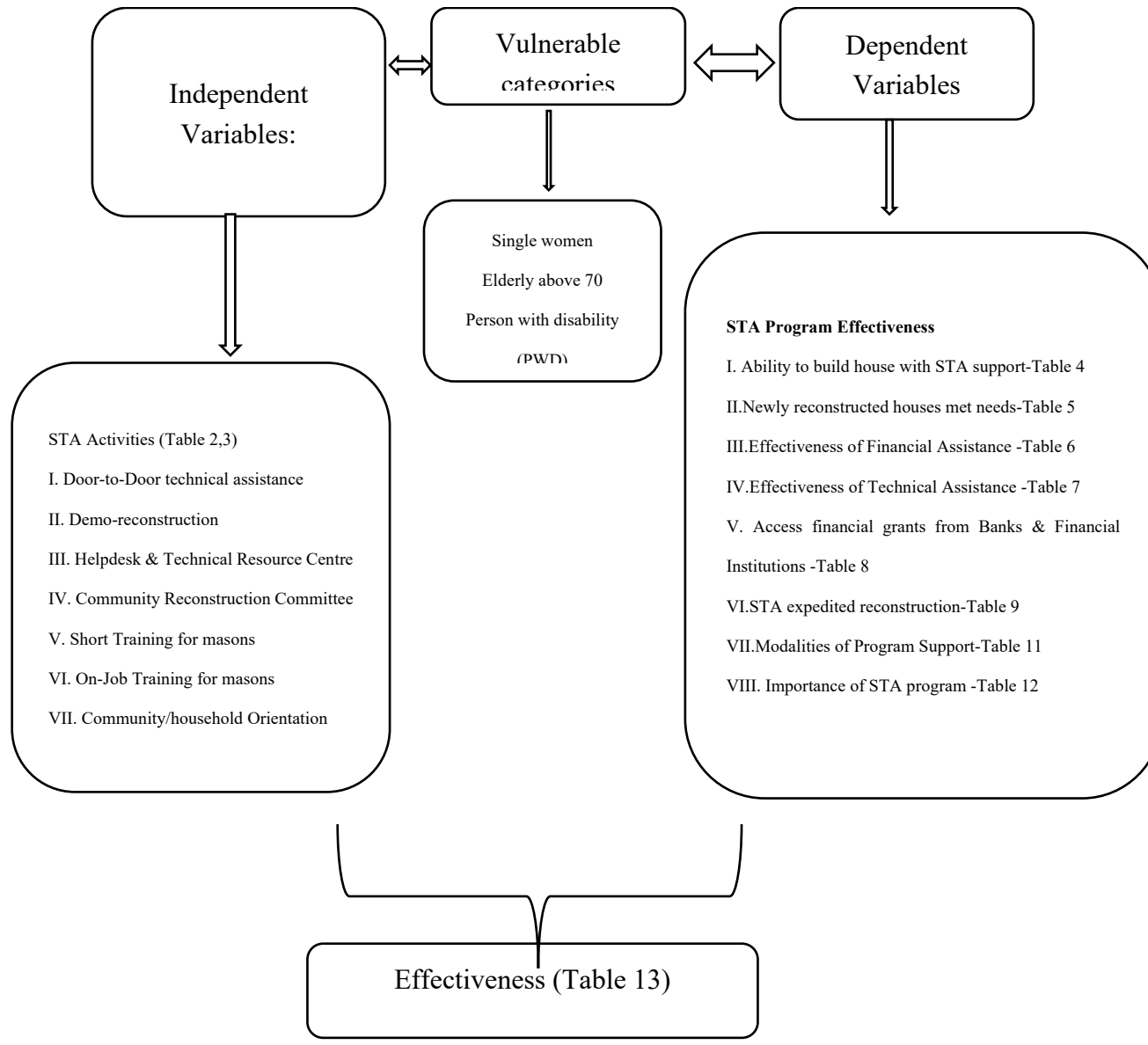


Figure 1. Conceptual Framework of this study.

Table 2. Socio-Technical Assistance (Independent Variables).

Socio-Technical Assistance (Seven Activities)	
I	Door-to-door technical assistance: Field mobile teams, including social mobilizers and mobile masons, provided on-site support, assisting vulnerable beneficiaries in accessing financial and technical aid, documentation, and overall reconstruction guidelines.
II	Demo-Reconstruction: Practical initiative clarifying construction information, customizing for local practices, complementing existing materials.
III.	Helpdesk & Technical Resource Centre: Provides reconstruction support and advice and facilitates access to information/resources through social mobilization staff.
IV	Community Reconstruction Committees: Enhance community participation, ownership, and coordination in the reconstruction process.
V	Short Training for Masons: a 7-day program to enhance mason skills, prioritizing earthquake-affected individuals, women, and the untrained.
VI	VI. On-the-Job Training for Masons: the 50-day program to expand the skilled labour force with expertise in earthquake-resistant structures.
VII.	Community/household Orientation: Enhance communication, create awareness of policies and standards, and coordinate with community committees and officials through the helpdesk/technical resource centre.

5. Description of the Study Area and Methodology

5.1. Nepal's Post-earthquake Owner-Driven Housing Reconstruction

The recovery concept involves rebuilding, restoring, rehabilitating and redeveloping, centered on “putting the community back together again”(Nigg, 1995). ODR approach prioritizes recipient “choice” and diverse household coping strategies to alleviate disaster impacts. Involvement in the design and building process significantly impacts psychological recovery households, empowering them and providing control over uncontrollable circumstances (Lyons, 2009). ODR was initially adopted as a ‘default strategy for post-disaster housing reconstruction after the 2001 Gujarat earthquake (2001), the South Asian tsunami (2004), and the Kashmir earthquake (2005) (Mishra, 2006; Mumtaz et al., 2008; Baker et al., 2010; Rawal et al., 2021).

Nepal's post-earthquake housing reconstruction is considered one of the largest owner-driven housing reconstruction programs globally, reconstructing more than 700,000 houses through a dedicated new entity ‘National Reconstruction Authority’. GoN provided uniform cash grants of NPR 300,000 (about \$3,000) to affected beneficiaries, disbursed in tranches tied to construction compliance. Partially damaged homes received NPR 100,000 (about \$1,000) in two tranches, with an additional NPR 50,000 (about \$500) top-up for vulnerable beneficiaries (HRRP, 2017a).

5.2. Socio-Technical Assistance Component

Despite the success of Owner-Driven Reconstruction (ODR) in constructing nearly 741,031(NRA, 2024) houses in Nepal, post-earthquake challenges persist for vulnerable populations. To address inclusivity, a Socio-Technical Assistance (STA) module was introduced in collaboration between the government and partner agencies to ensure that ‘No one is left behind.’ Recognizing the distinct needs of vulnerable beneficiaries, implementing the STA module was deemed necessary (HRRP, 2017a; 2020). GoN of Nepal identified 18,505 beneficiaries (2.4%) as vulnerable from 782,695 beneficiaries for the top-up housing assistance (Rawal et al., 2021).The STA program entails seven core activities (Refer-Fig 2), outlined by the NRA and HRRP , and complements financial and technical assistance by guiding beneficiaries to meet reconstruction standards within a specified timeframe (HRRP, 2017a; 2019). It aims for transformative change, requiring behavioural shifts and empowering communities through capacity-building training and income-generating activities.

The ODR model proved ineffective for vulnerable beneficiaries, leading to the recognition of the STA modality in the Post-disaster needs assessment, aligned with the “Leave No One Behind”

approach (NPC, 2015; NRA, 2016). Non-governmental agencies, avoiding a blanket approach, implemented the STA module, promoting the NRA to reintroduce the STA model due to its proven effectiveness in expediting reconstruction for the most vulnerable beneficiaries (JICA, 2019a; UNDP, 2019; Karki et al., 2020b; MDTF, 2021; NSET, 2021).

The key criteria for Socio-Technical Assistance are to:

- Engage all families and communities in timely and relevant guidance for safer and sustainable house construction, providing support throughout the inspection process.
- Enhance the availability and proficiency of skilled construction workers to facilitate reconstruction.
- Foster community resilience and long-term benefits.

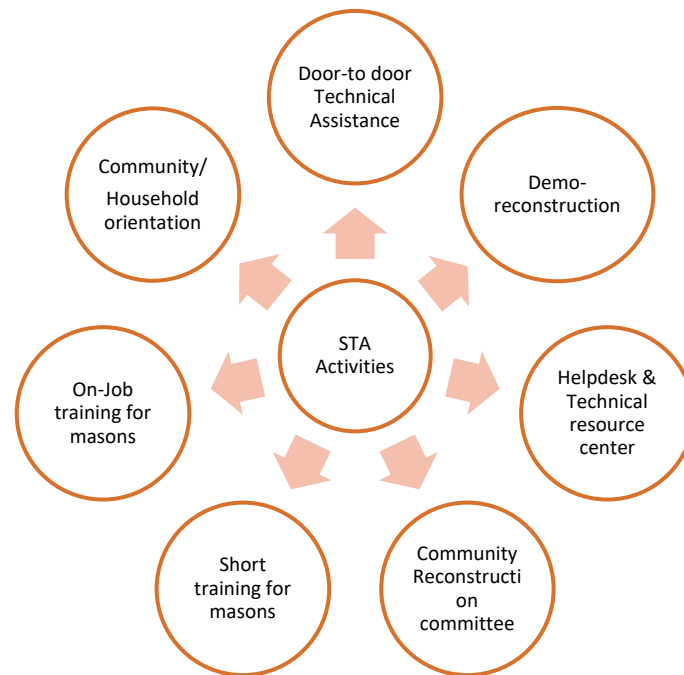


Figure 2. Core Socio-Technical Package; Source: (HRRP, 2017b).

5.3. Research Motivation, Geographical Locations, and Participants

First-hand experience the first author as a survivor during the 2015 Nepal Earthquake inspired a research focus on assessing the perspectives of ‘end-users’ regarding the effectiveness of post-disaster reconstruction activities, specifically STA combined with the ODR program. This study is part of a broader initiative examining post-disaster recovery among government-identified vulnerable beneficiaries, extending even into the eight years after the earthquake in the context of rural private housing reconstruction.

5.4. Data Collection Methods

The research employed a quantitative approach using a questionnaire survey gathered through a pen-and-paper survey administered to 304 vulnerable beneficiaries, later manually entered into JISC online software to ensure data quality. The field data collection occurred between May and July 2022 in Gorkha districts, covering three municipalities (Palungtar, Gorkha and Sulikot/Barpak). Cluster random sampling was used to select respondents. The questionnaire, designed by the author and translated into Nepali, ensured clarity and respondent anonymity using pseudonyms. Ethical approval and clearance were obtained from relevant authorities to conduct the study.

5.5. Sampling Size Calculation and Data Analysis

The survey targeted vulnerable beneficiaries identified by the Government of Nepal, National Reconstruction Authority (NRA), with a total of 18,505 individuals identified in 32 earthquake-

affected regions as vulnerable under criteria including senior citizens above 70 years, single women above 65 years and People with Disabilities (red or blue cardholders), excluding minors under 16 years due to ethical issues. Gorkha district was the center of the earthquake and classed as a 'highly affected' region; the total identified as a vulnerable population was (N)=1431, 95% confidence level (Z value),5% margin of error (e value), and 50% prevalence (p-value). From the calculation, the sample size becomes 304 for the questionnaire survey. Quantitative data analysis, including descriptive and Chi-square tests, were conducted using the statistical software SPSS.

5.6. Research Questions and Hypotheses

This research aims to assess the effectiveness of socio-technical assistance on vulnerable earthquake beneficiaries in Nepal, focusing on its effectiveness in private housing reconstruction, particularly those involved in private housing reconstruction. We quantitatively test the following research hypothesis using our database constructed from the primary survey.

- To what extent is the Socio-technical assistance program effective for earthquake-affected beneficiaries?

H1: There is no significant association between vulnerable categories and the likelihood of building a house with STA support.

H2: There is no significant association between vulnerable categories and the level of agreement on whether newly reconstructed houses met their needs in the STA program.

H3: There is no significant association between vulnerable categories and the perceived effectiveness of Financial Grants in the STA program.

H4: There is no significant association between vulnerable categories and the perceived effectiveness of Technical Assistance in the STA program.

H5: There is no significant association between vulnerable categories and the level of agreement on STA support in receiving tranches from Banks and Financial Institutions (BFIs)

H6: There is no significant association between vulnerable categories and the level of agreement on STA activities expediting reconstruction.

H7: There is no significant association between the vulnerable categories and the perceived importance of the STA program activities.

H8: There is no significant association between the vulnerable categories and the perceived DRR (disaster risk reduction) awareness of the STA Program.

6. Results and Discussion

The primary results are showcased in Tables 3–12, providing insights for effectively assessing ODR-STA program interventions among vulnerable earthquake beneficiaries in the study area.

I. Socio-Technical Assistance Activities

The study assessed the participation and effectiveness of the seven STA Activities, aligning with the overarching goal of ensuring that vulnerable beneficiaries reconstruct their homes and communities within specified standards and timeframes. Table 3 summarizes the engagement in STA activities among vulnerable beneficiaries, with the overall participation percentages as follows: (i) Community/household Orientation: 66.45 %, (ii) Door-to-door to technical assistance: 39.80%,(iii) Short Training for masons:60.86%, (iv) Helpdesk & communication centre: 29.28%,(v) Demo-construction: 34.21 %, (vi)Reconstruction committee support:9.87%, (vii) On-job training for masons:3.29%.

Table 3. Socio-Technical Assistance Seven Activities (STA).

STA Activities	Vulnerable Categories			Total
	Single Women above 65 Years	Elderly above 70 Years	Persons with disabilities (PWD)	

Total	Community/household Orientation	Count	62	124	16	202
		%	68.1%	63.9%	84.2%	66.45%
	Door to door technical assistance	Count	36	80	5	121
		%	39.6%	41.2%	26.3%	39.80%
	Short Training for masons	Count	51	122	12	185
		%	56.0%	62.9%	63.2%	60.86%
	Helpdesk & communication center	Count	25	59	5	89
		%	27.5%	30.4%	26.3%	29.28%
	Demo-Construction	Count	31	66	7	104
		%	34.1%	34.0%	36.8%	34.21%
Reconstruction committee support	Count	7	22	1	30	
	%	7.7%	11.3%	5.3%	9.87%	
On-job training for masons	Count	4	6	0	10	
	%	4.4%	3.1%	0.0%	3.29%	
Total	Count	91	194	19	304	

Percentages and totals are based on respondents.

a. Dichotomy group tabulated at value 1.

Source: Field Survey 2022.

Surveyed participants identified the most effective STA activities based on their engagement in supporting their reconstruction efforts as follows: (i) Orientation: 84.2% PWD, (ii) Door-to-door technical support: 41.2% Elderly above 70, (iii) Short training: 63.2 % PWD,(iv) Helpdesk information centre:30.4% Elderly above 70,(v) Demo reconstruction:36.8% PWD,(vi) Reconstruction committee support:11.3% Elderly above 70 and (vii) Vocational training: 4.4% of single women; responded to expedite their reconstruction to complement the ODR housing reconstruction model through tailored STA activities.

II. Ability to build a house with STA program Intervention.

This outcome demonstrates the impact of STA program activities on the capacity of vulnerable beneficiaries to construct houses. Table 4 presents responses from these beneficiaries, probing whether they could have independently built their houses without STA support. *Nearly 89% of surveyed participants indicated they would have needed help to construct a house independently.*

Table 4. Could you have built your house without STA Support?

		Vulnerable Categories				
		Single Women above 65 Years	Elderly above 70 Years	Person with disability (PWD)	Total	
Could you have built your house without STA support?	No, could not	Count	83	169	18	270
		%	91.2%	87.1%	94.7%	88.8%
	Yes, could	Count	8	25	1	34
		%	8.8%	12.9%	5.3%	11.2%
Total		Count	91	194	19	304
		%	100.0%	100.0%	100.0%	100.0%
Chi-Square Tests						
		Value	df	Asymp. Sig. (2-sided)		
Pearson Chi-Square		1.761 ^a	2	0.415		

Source: Field Survey 2022.

Additionally,91.2 % of single women above 65 years, 87.1 % of elderly citizens above 70 years, and 94.7% of persons with disabilities (PWD) stated that they would not have been able to build on their own without STA support. The lack of a significant difference among the three vulnerable

categories is indicated by a p-value of 0.415 (Accepted H1), suggesting a similar situation for all vulnerable groups.

III. Newly Reconstructed House Met Needs

The results in Table 5 show that surveyed respondents responded to the statement “*Newly reconstructed house met needs*” as follows on average in total: Strongly Agree: 22.2 %, Agree: 58.6%, Neither agree nor disagree: 3.3 %, Disagree: 10.9%, Strongly Disagree: 5.0%, with an average mean of 2.18, which is close to the Agree overall.

Table 5. Newly Reconstructed House Met Needs.

		Vulnerable Categories			Total	
		Single Women above 65 Years	Senior Citizen above 70 Years	PWD		
New reconstruction house met	Strongly Agree	Count	18	46	3	67
		%	19.8%	24.0%	15.8%	22.2%
	Agree	Count	59	107	11	177
		%	64.8%	55.7%	57.9%	58.6%
	Neither agree or disagree	Count	4	5	1	10
		%	4.4%	2.6%	5.3%	3.3%
	Disagree	Count	8	23	2	33
		%	8.8%	12.0%	10.5%	10.9%
	Strongly Disagree	Count	2	11	2	15
		%	2.2%	5.7%	10.5%	5.0%
Total	Count	91	192	19	302	
	%	100.0%	100.0%	100.0%	100.0%	
Average Mean		2.18				
Chi-Square Tests						
	Value	Df	Asymp. Sig. (2-sided)			
Pearson Chi-Square	5.956 ^a	8	0.652			

Source: Field Survey 2022.

Table 5 indicates an overall positive response of 81 %, with 22% strongly agreeing and 59% agreeing that the newly reconstructed houses met their needs. There is no significant association among all vulnerable categories regarding the “New Reconstruction House met needs” program support, as the p-value is 0.652 (Accepted H2), suggesting unanimous agreement across all beneficiary groups.

VI. Effectiveness of Financial Grant

The below depicts the effectiveness of financial grants by the respondents, which was measured through the Likert scale (Highly effective=3, Effective =2, Less effective=1, Not effective=0). The average mean is 2.84 with a minimum of 1 and a maximum of 3, close to the highly effective. So, it is found that STA's role in supporting obtaining financial grants is highly effective for vulnerable beneficiaries.

The results in Table 6 show that 84% of beneficiaries highly rated the government's financial grant program, with 15.1% considering it effective and none perceiving it as ineffective. Only 0.7% found it less effective. The findings indicate a unanimous positive impact of financial grants, with no significant difference among vulnerable categories, as indicated by a p-value of 0.874 (Accepting H3).

Table 6. Effectiveness of Financial Grant.

Effectiveness of Financial Grant	Vulnerable Categories			Total
	Single Women above 65 Years	Senior Citizen above 70 Years	PWD	

Financial Grant	Less effective	Count	1	0	2
		%	1.1%	0.5%	0.0%
	Effective	Count	12	30	4
%		13.2%	15.5%	21.1%	15.1%
Highly effective	Count	78	163	15	256
	%	85.7%	84.0%	78.9%	84.2%
Total	Count	91	194	19	304
	%	100.0%	100.0%	100.0%	100.0%
Average Mean			2.84		
Chi-Square Tests					
		Value	df	Asymp. Sig. (2-sided)	
Pearson Chi-Square		1.223 ^a	4	0.874	

Source: Field Survey 2022.

VII. Effectiveness of Technical Assistance

As surveyed respondents, the effectiveness of Technical Assistance is illustrated below, measured on a Likert scale (Highly effective=3, Effective =2, Less effective=1, Not effective=0). The average mean is 2.32, with a minimum mean of 1 and a maximum of 3, indicating close effectiveness. Therefore, it is concluded that STA effectively supports vulnerable beneficiaries in obtaining Technical Assistance.

The results in Table 7 reveal that a minimal 2.3% of beneficiaries perceived technical assistance as less effective, while the vast majority (98%) found it effective. The findings affirm the equal distribution of the STA program among all vulnerable categories, including women, seniors, and persons with disabilities, with a P-value of 0.731 (Accepting H4), indicating unbiased support based on the humanitarian aid principle.

Table 7. Effectiveness of Technical Assistance.

Effectiveness of Technical Assistance	Vulnerable Categories			Total	
	Single Women above 65 Years	Senior Citizen above 70 Years	PWD		
Technical Assistance	Less effective	Count	5	1	7
		%	1.1%	2.6%	5.3%
	Effective	Count	61	119	11
%		67.0%	61.7%	57.9%	63.0%
Highly effective	Count	29	69	7	105
	%	31.9%	35.8%	36.8%	34.7%
Total	Count	91	193	19	303
	%	100.0%	100.0%	100.0%	100.0%
Average Mean			2.32		
Chi-Square Tests					
		Value	Df	Asymp. Sig. (2-sided)	
Pearson Chi-Square		2.026 ^a	4	0.731	

Source: Field Survey 2022.

VIII. STA support in accessing financial grants from Banks and Financial Institutions (BFIs)

Table 8 presents survey results evaluating the contribution of STA activities to accessing financial grants from Banks and Financial Institutions (BFIs). Overall, the responses based on the Likert scale include (Strongly Agree= 1, Agree=2, Neither agree nor disagree=3, Disagree=4, Strongly Disagree=5) where data shows that Strongly agreed:33.3%, Agreed: 45.9%, Neither agreed no disagreed:3.6%, Disagreed:13.2% and Strongly Disagreed:4% with average mean is 2.09 which is close to the Agree in overall.

Table 8. STA support in receiving tranches from Banks & Financial Institutions (BFIs).

		Vulnerable Categories			Total
		Single Women above 65 Years	Senior Citizen above 70 Years	PWD	
STA support in receiving tranches from BFIs.	Strongly Agree	Count 33 % 36.7%	61 31.4%	7 36.8%	101 33.3%
	Agree	Count 39 % 43.3%	92 47.4%	8 42.1%	139 45.9%
	Neither agree or disagree	Count 6 % 6.7%	4 2.1%	1 5.3%	11 3.6%
	Disagree	Count 8 % 8.9%	29 14.9%	3 15.8%	40 13.2%
	Strongly Disagree	Count 4 % 4.4%	8 4.1%	0 0.0%	12 4.0%
	Total	Count 90 % 100.0%	194 100.0%	19 100.0%	303 100.0%
Average mean		2.09			
Chi-Square Test					
		Value	Df	Asymp. Sig. (2-sided)	
Pearson Chi-Square		7.236 ^a	8	0.511	

Source: Field Survey 2022. There is no significant correlation among vulnerable categories regarding program support for receiving tranches from BFIs, with a P value of 0.511, surpassing the 0.05 significance level. The result accepted H5; overall, 79.2% of all vulnerable categories responded positively, with 33.3 % strongly agreeing and 45.9% agreeing.

IX. STA Activities Expedited Reconstruction

The following results illustrate the surveyed respondents' views on how STA activities facilitated reconstruction, assessed on a Likert scale (Strongly agree= 1, Agree=2, Neither agree nor disagree=3, Disagree=4, Strongly Disagree=5). The overall average responses were strongly agreed: 25.8%, Agreed: 70.5%, disagreed: 2.3%, and strongly Disagree: 1.3 %, with an average mean of 1.83, close to Agree overall.

Table 9. STA Expedited Reconstruction.

		Vulnerable Categories			Total
		Single Women above 65 Years	Senior Citizen above 70 Years	PWD	
STA Activities Expedited Reconstruction	Strongly Agree	Count 18 % 20.0%	53 27.5%	7 36.8%	78 25.8%
	Agree	Count 70 % 77.8%	133 68.9%	10 52.6%	213 70.5%
	Disagree	Count 2 % 2.2%	4 2.1%	1 5.3%	7 2.3%
	Strongly Disagree	Count 0 % 0.0%	3 1.6%	1 5.3%	4 1.3%
	Total	Count 90 % 100.0%	193 100.0%	19 100.0%	302 100.0%
	Average mean		1.83		
Chi-Square Tests					
		Value	Df	Asymp. Sig. (2-sided)	
Pearson Chi-Square		8.139 ^a	6	0.228	

Source: Field Survey 2022. There is no significant difference among vulnerable categories regarding STA intervention support for house reconstruction, with an overall positive response of 96.3%. The Chi-square test accepted H₀, suggesting that the program benefited all vulnerable beneficiaries equally. The P value (0.228) exceeded the 0.05 significance level.

X. Modalities of STA Program Support Reception

Results from Table 10 show that 77.6% of respondents, especially single women above 65 years (78.0%) and elderly above 70 years (77.3%), self-approached for STA program activities. Organizations approached a smaller percentage (9.8%), 29.28% were recommended or referred, and 65.79% received support through the local community. Moreover, 4.93% were assisted by social mobilizers.

Table 10. Modalities of STA Program Support Reception.

How did you receive the program support?	Vulnerable Categories			Total
	Single Women above 65 Years	Senior Citizen above 70 Years	PWD	
Self-approached for the need of the program activities	Count 71 % 78.0%	150 77.3%	15 78.9%	236 77.6%
Approached by organization	Count 6 % 6.6%	13 6.7%	1 5.3%	20 9.80%
Total Recommended or referred	Count 21 % 23.1%	61 31.4%	7 36.8%	89 29.28%
Local community	Count 61 % 67.0%	124 63.9%	15 78.9%	200 65.79%
Social mobilizer	Count 5 % 5.5%	9 4.6%	1 5.3%	15 4.93%
Total	Count 91	194	19	304

Percentages and totals are based on respondents.
a. Dichotomy group tabulated at value 1.

Source: Field Survey 2022.

Results from Table 10 show that approximately 78% of single women and around 77-79% of vulnerable individuals needed urgent support from the STA program intervention, leading them to self-approach for expediting reconstruction efforts. The findings suggest varied pathways for receiving program support, with a notable trend of self-initiation by vulnerable beneficiaries.

XI. Importance of STA program activities

Table 11 gauges the perceived importance of the STA program activities among different vulnerable categories measured on the Likert scale (Strongly agree=1, Agree=2, Neither agree nor disagree=3, Disagree=4, Strongly Disagree=5). Many respondents across all vulnerable categories agreed that the STA support program was crucial for their reconstruction efforts.

Table 11. Importance of STA program activities.

	Vulnerable Categories			Total	
	Single Women above 65 Years	Senior Citizen above 70 Years	PWD		
STA support program was very important for	Strongly Agree	Count 31 % 34.1%	60 30.9%	4 21.1%	95 31.2%
	Agree	Count 55 % 60.4%	126 64.9%	14 73.7%	195 64.1%
	Neither agree nor disagree	Count 1 % 1.1%	7 3.6%	1 5.3%	9 3.0%
	Disagree				
	Strongly Disagree				

Strongly Disagree	Count	4	1	0	5
	%	4.4%	0.5%	0.0%	1.6%
Total	Count	91	194	19	304
	%	100.0%	100.0%	100.0%	100.0%
Average Mean		1.80			

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	9.037 ^a	6	0.171

Source: Field Survey 2022. The results reveal no significant difference in the perceived importance of the STA program among various vulnerable categories for house building. With a P-value of 0.171, surpassing the 0.05 significance level, the collective response of 95, with 31.2% strongly agreeing and 64.1% agreeing, suggests an overall positive sentiment with an average mean of 1.80, close to Agree overall. The chi-square test value accepted H7, indicating equal importance of this program across all groups. Persons with disabilities consistently rated the support higher than the other two categories across all table categories.

XII. Disaster Risk Reduction (DRR) Awareness by STA program

Table 12 provides insights into Disaster Risk Reduction (DRR) awareness among vulnerable categories in the STA program. Across single women above 65 years, senior citizens above 70 years, and persons with disabilities (PWD).

Table 12. DRR Awareness by STA Program.

	Vulnerable Categories				Total		
	Single Women above 65 Years		Senior Citizen above 70 Years			PWD	
	Count	%	Count	%			
Strongly Agree	25	27.8%	71	36.8%	6	102	33.8%
Agree	54	60.0%	94	48.7%	10	158	52.3%
Neither agree or disagree	3	3.3%	8	4.1%	0	11	3.6%
Disagree	3	3.3%	11	5.7%	2	16	5.3%
Strongly Disagree	5	5.6%	9	4.7%	1	15	5.0%
Total	90	100.0%	193	100.0%	19	302	100.0%
Average mean		1.95					
Chi-Square Tests							
	Value	Df			Asymp. Sig. (2-sided)		
Pearson Chi-Square	5.648 ^a	8			0.687		

Source: Field Survey 2022. The results indicate no significant difference in Disaster Risk Reduction (DRR) awareness among vulnerable categories through the STA program. A majority (87.8%) of respondents express positive DRR awareness, with 27.8% strongly agreeing and 60.0% agreeing. Dissenting opinions are minimal at 9.0%. The Chi-square test result (5.648, p-value=0.687) surpassed the 0.05 significance level, suggesting a consistent DRR awareness across all vulnerable categories. Therefore, H8 is accepted, indicating a positive and uniform understanding of DRR among the target groups.

XIII. Effectiveness of the STA Program Activities

The table presents the effectiveness of the Socio-technical assistance (STA) program activities, focusing on vulnerable categories such as single women above 65, senior citizens above 70, and persons with disabilities (PWD).

- Financial Support: All three vulnerable categories show high percentages (99% to 100%) in acknowledging the effectiveness of financial support in their reconstruction.
- Technical Support: Over 90% in each vulnerable category perceive technical support as effective in aiding recovery.
- Accessible House: While there is a variation across categories, ranging from 70.3% to 78.9%, a substantial majority acknowledges housing accessibility as beneficial.
- Build Earthquake Resilient (EQ) House: A high percentage (94.7% to 96%) across vulnerable categories acknowledges the effectiveness of building earthquake-resilient houses.
- Improved Livelihood: The majority in each category (79.1% to 94.7%) recognize the program's impact on enhancing their livelihoods.
- Training & Orientations: Strong positive perceptions (82.4% to 84.5%) indicate the importance of training and orientation in recovery.
- Sufficient Place to Live-In: Most respondents (73.6% to 89.5%) express satisfaction with providing sufficient living space.
- Enhanced Safety: Across all vulnerable categories, a significant proportion (84.6% to 89.5%) perceive the program as contributing to enhanced safety.

The survey reports unanimously demonstrate the remarkable success of program implementation in meeting the fundamental needs of vulnerable beneficiaries, significantly aiding their recovery efforts. The consistently high percentages across different program components underscore the program's effectiveness in comprehensively addressing the diverse needs of the identified vulnerable categories.

7. Result of Hypothesis Testing

S. N	Hypothesis	P-Value Chi-Square Test	Results
H1	There is no significant association between vulnerable categories and the likelihood of building a house with STA support	0.415 (Table 4)	Accepted
H2	There is no significant association between vulnerable categories and the level of agreement on whether newly reconstructed houses met their needs in the STA program.	0.652 (Table 5)	Accepted
H3	There is no significant association between vulnerable categories and the perceived effectiveness of Financial Grants in the STA program.	0.874 (Table 6)	Accepted
H4	There is no significant association between vulnerable categories and the perceived effectiveness of Technical Assistance in the STA program.	0.731 (Table 7)	Accepted
H5	There is no significant association between vulnerable categories and the level of agreement on STA support in receiving tranches from Banks and Financial Institutions (BFIs)	0.511 (Table 8)	Accepted
H6	There is no significant association between vulnerable categories and the level of agreement on STA activities expediting reconstruction.	0.228 (Table 9)	Accepted

H7	There is no significant association between the vulnerable categories and the perceived importance of the STA program activities.	0.171 (Table11)	Accepted
H8	There is no significant association between the vulnerable categories and the perceived DRR Awareness by the STA program.	0.687 (Table12)	Accepted

8. Discussion

The study reveals significant findings related to the effectiveness of Socio-Technical Assistance (STA) interventions in post-disaster reconstruction. The findings demonstrate substantial income increase for masons and a noteworthy inclusion of women in the workforce (Table 3). Orientation and training efforts accelerated reconstruction by 75% (Build Change, 2014; Lamsal et al., 2020; Manindra Malla, 2020), with approximately 20% of the 755 recruited masons being women, also reported by other studies (The World Bank, 2020-2021). Furthermore, both governmental entities significantly expedited reconstruction efforts, supported by various studies (Dhungel et al., 2019; Gouli et al., 2019; JICA, 2019a; Bishwakarma, 2020; The World Bank, 2020-2021; Rawal et al., 2021).

The role of tailored STA support for vulnerable beneficiaries is crucial, as it significantly contributes to socio-economic recovery and livelihood reinstatement (Table 4), also revealed by other studies (Dhungel et al., 2019; Gouli et al., 2019; JICA, 2019a; The World Bank, 2021a; UNDP, 2021b; 2021c). Field survey results indicate that 89% of beneficiaries could not build their houses without focused STA program intervention, with over 97.1% findings it both practical and necessary, reinforcing the effectiveness and importance of such interventions, as supported by another study (Karki et al., 2020b; Manindra Malla, 2020). Similarly positive perceptions of reconstruction grants are highlighted, with over 90.59% of beneficiaries finding them easy and timely (Table 5). A substantial portion of beneficiaries-initiated reconstruction promptly upon receiving the grant, aligning with FWLD's (2017) findings that more than 61% of beneficiaries initiated reconstruction promptly upon receiving the grant.

The importance of technical and financial assistance for knowledge transfer skills development in post-disaster reconstruction is emphasized (Table 6 and 7). Prior study by Manindra Malla (2020) emphasized the importance of technical assistance by 92% and another study by Hülssiep et al. (2021) also evidenced the need of financial and technical assistance and access to finance by 94% in April 2016 and 97% in June 2016. This findings aligns with various project based reports underscoring the role of these elements in building resilience also revealed in other disaster contexts (Arshad & Athar, 2013; IFRC, 2018). These findings align with other project-based reports (JICA, 2019a; The World Bank, 2019; 2021a; NSET, 2023) and other project based studies (Dhungel et al., 2019; Karki et al., 2020b; Rawal et al., 2021). Previous research also highlighted enhanced financial access for disadvantaged segments due to post-earthquake housing reconstruction initiatives (Build Change, 2014; Bhusal et al., 2020).

STA's contribution to imparting disaster resilience skills, creating employment opportunities, and supporting the Owner-Driven Reconstruction (ODR) approach to reinstate livelihoods is notable (Table 8). The initiative is found to be imparting technical skills, creating employment opportunities for both men and women by project-based reports (IFRC, 2018; The World Bank, 2020).

STA activities expedited reconstruction, with an overall average agreed response of 96.30% (Table 9). The implementation of STA resulted in a high construction compliance rate of 81% validated by project based studies to validate the effectiveness (Gouli et al., 2019). The perceived need for the STA program by 77.6% of respondents is consistent with findings from other studies (Table 10) (Dhungel et al., 2019; Gouli et al., 2019; Karki et al., 2020b).

Post-disaster reconstructed houses provide a safe and dignified shelter, serving as valuable assets and enhancing disaster resilience for beneficiaries (Table 12). Similarly, another study by FWLD

(2017) found that 80.32 % of female-owner beneficiaries perceived the effectiveness of earthquake resilience.

The effectiveness of the STA program combined with technical and financial assistance in accelerating reconstruction efforts is emphasized, aligning with the principle of ‘No One Left Behind’ (Tables 11 and 13) (Dhungel et al., 2019; Gouli et al., 2019; Scott Wilson Nepal, 2019; Rawal et al., 2021; The World Bank, 2021b). Consistent positive responses from beneficiaries regarding the STA program’s satisfaction and effectiveness are supported by previous research (Karki et al., 2020a; Bhusal & Bhattarai, 2023). Additionally, 92 % reported that STA activities supported building back better (Manindra Malla, 2020). Vulnerable earthquake beneficiaries also provided positive responses regarding friendly house design in the study area of the Gorkha district (women: 80.49%, Children: 61.46%, Persons with Disability: 43.90% and Elderly: 52.20% (FWLD, 2017). Therefore, this research study evidences the effectiveness of STA program intervention, as revealed by prior project-based studies and reports.

Table 13. Effectiveness of the STA Program Activities.

How did the STA support program benefit you in your reconstruction and recovery endeavors?		Vulnerable Categories			Total
		Single Women above 65 Years	Senior Citizen above 70 Years	PWD	
Financial support	Count	91	192	19	302
	%	100.0%	99.0%	100.0%	99%
Technical support	Count	86	180	18	284
	%	94.5%	92.8%	94.7%	93%
Accessible House	Count	64	137	15	216
	%	70.3%	70.6%	78.9%	71%
Build Earthquake resilient (EQ) House	Count	87	186	18	291
	%	95.6%	95.9%	94.7%	96%
Improved livelihood	Count	72	155	18	245
	%	79.1%	79.9%	94.7%	81%
Training & Orientations	Count	75	164	16	255
	%	82.4%	84.5%	84.2%	84%
Sufficient place to live-in	Count	67	159	17	243
	%	73.6%	82.0%	89.5%	80%
Enhanced safety	Count	77	168	17	262
	%	84.6%	86.6%	89.5%	86%
Total	Count	91	194	19	304

Percentages and totals are based on respondents.

a. Dichotomy group tabulated at value 1.

Source: Field Survey 2022.

This study contributes substantially to post-disaster humanitarian literature by addressing a critical knowledge gap in the shelter and settlement response, specifically examining Nepal’s private housing reconstruction from the earthquake epicentre region from vulnerable households’ perspectives eight years after a disaster as there is limited independent academic research. The study empirically evidences the significant impact of the STA program combined with the Owner-Driven Reconstruction (ODR) model, particularly for individuals struggling with self-reconstruction; this study offers groundbreaking insights from Nepal’s world’s largest ODR housing recovery initiative. It also highlights that the ODR model, though widely preferred as a ‘global reconstruction strategy’ in low-income countries, requires tailored approaches rather than a universal application. Furthermore, the research aligns with the United Nation’s Sustainable Development Goal (UN SDG: Goal 11), offering valuable insights for fostering sustainable cities and communities in disaster-prone regions.

9. Limitations

The study faced several limitations, including a confined number of collected variables, limited data scale values, and a focus on one district in rural housing reconstruction and three municipalities out of the 14 highly affected districts. Additionally, participant responses were influenced by their understanding of the questionnaire, education level and mood during completion. Future research could enhance generalizability by increasing the sample size to include 31 earthquake-affected regions, thereby capturing diverse perceptions of vulnerable beneficiaries. Further investigations in 14 'highly affected' and 17 'less affected' districts, focusing on vulnerable or non-recipients of STA interventions or those solely relying on ODR, can be explored using qualitative study to consider specific needs of families, challenges and detailed experiences with the reconstruction process will provide a deeper understanding of these dynamics. This study focused on a particular episode of the disaster; the broader issues, such as environmental degradation, climate change, and socio-economic vulnerability, will be incorporated in the next paper and our long-term research study on the relationship between disaster and economic development. To address this, we will broaden the scope and diversify the sample size in future studies.

10. Conclusion

In conclusion, this research examined the effectiveness of Socio-Technical Assistance (STA) in aiding vulnerable beneficiaries during post-disaster reconstruction programs. The study revealed that 302 out of 304 respondents surveyed in the field (99.3%) successfully completed their reconstruction efforts, highlighting positive outcomes in various aspects such as financial support, technical assistance, accessible housing, earthquake-resilient construction, improved livelihoods, training, sufficient living spaces, and enhanced safety. The predominant trend of self-help approach by beneficiaries highlighted their urgency in seeking assistance. The research underscores the vital role of STA interventions in accelerating reconstruction and addressing specific needs, as is evident by overwhelmingly positive participant responses. The perceived importance of STA and positive Disaster Risk Reduction (DRR) awareness underscores its significance for immediate recovery and long-term resilience. Overall, the study highlights the effectiveness of the Owner-Driven Reconstruction (ODR) approach with tailored STA activities.

The research highlights the weakness of relying solely on ODR indicating challenges faced by vulnerable beneficiaries who were unable in independently driving the reconstruction of houses on their own (see Table 1). Moreover, it sheds light on the limited evidence from the perspectives of vulnerable recipients, stressing the need to customize STA modalities in future post-disaster rural private housing reconstruction endeavors. These insights provide valuable guidance for post-disaster humanitarian responses and advocate for strategic policy considerations, promoting the integration of STA into comprehensive recovery strategies and fostering awareness of Disaster Risk Reduction (DRR) for future sustainable recovery efforts to build resilient communities.

Author Contributions: The paper was conceived by N.P.B, is based on her unpublished PhD thesis from the Faculty of Business, Law and Politics, University of Hull, UK. She developed the methodological approach, conducted the literature review, and gathered information from various sources. K. B and F.W, who supervised the thesis, provided guidance during its production, revised and edited the manuscript, contributed to re-writing sections, and sourced additional information and images. All authors have read and approved the final version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Ethical clearance was obtained from the University of Hull for the field research and informed consent from respondents of the survey.

Data Availability Statement: Data used in this paper will be available upon request.

Conflicts of Interest: The authors declare no conflict of interest.

Declaration of Interests: We affirm the accuracy of the provided information and confirm the absence of any actual, potential, or perceived conflicts of interest. No competing financial interests or personal relationships could be perceived as influencing the work presented in this paper.

Appendix A

Table A1. Completion of House Reconstruction.

Q22.COMPLETED OR NOT		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Under reconstruction	2	.7	.7	.7
	Completed	302	99.3	99.3	100.0
	Total	304	100.0	100.0	

Table A2. Opening of Bank Account.

Q18.BANK A/C		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	After Earthquake	196	64.5	64.5	64.5
	Before Earthquake	108	35.5	35.5	100.0
	Total	304	100.0	100.0	

Table A3. Living in the Newly Reconstructed House.

Q25.LIVE IN OR NOT		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	3	1.0	1.0	1.0
	Yes	300	98.7	99.0	100.0
	Total	303	99.7	100.0	
Missing	System	1	.3		
Total		304	100.0		

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