


# Rethinking relief, reconstruction and development: Evaluating the effectiveness and sustainability of post-disaster livelihood aid

**Journal Article****Author(s):**

Daly, Patrick; Mahdi, Saiful; [McCaughey, Jamie W](#) ; Mundzir, Ibnu; Halim, Agus; Nizamuddin; Ardiansyah; Srimulyani, Eka

**Publication date:**

2020-10

**Permanent link:**

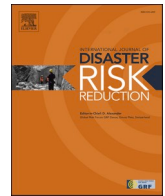
<https://doi.org/10.3929/ethz-b-000417504>

**Rights / license:**

[Creative Commons Attribution 4.0 International](#)

**Originally published in:**

International Journal of Disaster Risk Reduction 49, <https://doi.org/10.1016/j.ijdr.2020.101650>



## Rethinking relief, reconstruction and development: Evaluating the effectiveness and sustainability of post-disaster livelihood aid

Patrick Daly<sup>a,\*</sup>, Saiful Mahdi<sup>b</sup>, Jamie McCaughey<sup>c</sup>, Ibnu Mundzir<sup>d</sup>, Agus Halim<sup>e</sup>, Nizamuddin<sup>f</sup>, Ardiansyah<sup>g</sup>, Eka Srimulyani<sup>h</sup>

<sup>a</sup> Earth Observatory of Singapore, Nanyang Technological University, Singapore

<sup>b</sup> Department of Statistics, Syiah Kuala University, Indonesia

<sup>c</sup> Institute for Environmental Decisions, ETH Zurich, Switzerland

<sup>d</sup> International Centre for Aceh and Indian Ocean Studies, Indonesia

<sup>e</sup> Department of Agriculture, Syiah Kuala University, Indonesia

<sup>f</sup> Department of Informatics, Syiah Kuala University, Indonesia

<sup>g</sup> Department of Electrical and Computer Engineering, Syiah Kuala University, Indonesia

<sup>h</sup> Ar-Raniry State University, Indonesia

### ARTICLE INFO

#### Keywords:

Aceh  
Tsunami  
Livelihoods  
Post-disaster reconstruction  
Humanitarianism  
Economic development

### ABSTRACT

This paper presents a field study on the long-term effectiveness and sustainability of livelihood interventions following the 2004 Indian Ocean tsunami in Aceh, Indonesia. We assess the extent to which post-tsunami aid in Aceh helped beneficiaries to stabilize and restore their pre-disaster livelihoods, and/or develop new livelihoods. We draw upon qualitative data captured in 183 in-depth interviews and 38 focus group discussions involving village leaders, livelihood aid participants, and NGO workers. Our results show that livelihood assistance helped people stabilize their household finances and partially restore their pre-disaster livelihoods. Furthermore, we found that aid programs were able to help some people without pre-disaster livelihood experience to participate in part-time, ad hoc work. However, aid packages were generally not able to support the development of full-time, sustainable new livelihoods for people lacking pre-disaster training and experience. Our data suggests that it is difficult to conduct efficient and sustainable livelihood development initiatives within the time pressures and current institutional approaches to large-scale post-disaster reconstruction.

### 1. Introduction

Disasters can cause extensive disruption to livelihoods through the destruction of productive infrastructure, assets, and stock, break-down of lifeline systems such as utilities, communication services and financial systems, reduction of labor and customer pools, and disruption of markets and supply chains [1,2]. While there are diverging opinions on post-disaster macroeconomic recovery,<sup>1</sup> research on post-disaster livelihoods indicates that recovery can be influenced by the extent of the physical damage caused by a disaster and by levels of individual and household economic insecurity [3]. Furthermore, small

and localized businesses/livelihoods might struggle to cope and recover, especially if they are part of the informal economy and lack insurance and/or access to capital [1,3–7]. These latter points encapsulate many of the livelihoods found within the developing world, making them especially vulnerable to disasters.

The increased focus on livelihood vulnerability by practitioners and academics has led to a broad consensus that livelihood assistance should be prioritized in post-disaster situations, especially within the developing world [8–14]. This has led to the incorporation of the sustainable livelihoods framework within disaster response plans to support the rehabilitation and restoration of livelihoods [15–17]. Additionally, it

\* Corresponding author.

E-mail address: [patrickdaly@ntu.edu.sg](mailto:patrickdaly@ntu.edu.sg) (P. Daly).

<sup>1</sup> Some studies have shown that disasters can have long-lasting negative economic impacts, which set back development and growth [63, 64, 65, 66, 67]. Other scholars argue that post-disaster reconstruction can stimulate development, fuelled by inflows of funding and the opportunity to upgrade the productive capacity of facilities and infrastructure [1, 68, 69, 71, 72]. These different findings reflect the complex and unique factors faced in each post-disaster context, such as pre-disaster livelihood profiles, levels of economic diversification and development, extent of damage, governance structures, access to resources, timeframe and scale of analysis, and policy decisions about reconstruction [73, 74, 63, 75, 76].

<https://doi.org/10.1016/j.ijdr.2020.101650>

Received 28 November 2019; Received in revised form 19 April 2020; Accepted 5 May 2020

Available online 11 May 2020

2212-4209/© 2020 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>).

has become widely accepted that governments, donors and NGOs should use the ‘opportunity’ presented by the disaster to go beyond the pre-disaster state by increasing economic efficiency, productivity and resilience, and supporting the creation of new and more inclusive employment opportunities [18–24]. The latter aspect is part of the call to link relief, reconstruction, and development (LRRD) – a major component of the ‘build-back-better’ approach that has become prominent within post-disaster discourse since the 2004 Indian Ocean tsunami [23,25–29].

The 2004 tsunami caused horrific loss of life, extensive destruction to the built and natural environments, and had a major impact upon livelihoods in Aceh, Indonesia [8,30–34]. In response, initial needs assessments and the Indonesian government reconstruction master-plan stressed the importance of providing livelihood assistance to restore pre-tsunami activity and to promote sustainable development [35,36]. According to the Recovery Aceh-Nias Database (RAND), which tracked \$3.27 billion in aid projects, approximately 12%, or \$394 million USD, was spent on livelihood recovery and rehabilitation programs, carried out by dozens of NGOs [37]. The response to the 2004 tsunami was the first large-scale internationalized post-disaster reconstruction campaign that incorporated LRRD as a foundational principle and as such is an important test case for its effectiveness.

Research on the efficacy of post-tsunami aid programs in Aceh generally presents a picture of inefficiency, waste, and poor coordination [23,27,29,37–41]. The distribution of poor quality and inappropriate aid has been widely reported – especially for the fishing sector [37,42–44]. Authors attribute these aid failures to disconnect between aid distribution agencies and beneficiaries and the lack of collaboration with local stakeholders to customize aid packages to meet local needs [37,43,45,46]. While not empirically robust, the literature on post-tsunami livelihood aid gives the general impression that programs restoring pre-disaster livelihoods seem to have higher rates of success than development initiatives that tried to introduce new types of livelihoods, train people to enter the workforce, or start up a small business [3,25,27,28,37,38,47].

Most of these assessments of post-tsunami livelihood assistance were conducted during the reconstruction period – and therefore are able to usefully comment on aid distribution and utilization *while* aid projects were on-going. However, there is a lack of systematic research conducted after the end of the reconstruction period on the longer-term effectiveness and sustainability of these livelihood interventions. Additionally, most of the research on post-disaster livelihood assistance focuses on practical failures but does not interrogate the conceptual foundation of merging relief, reconstruction and development.

This leaves gaps in our knowledge about the viability of livelihood assistance to restore pre-disaster livelihoods and promote new economic development outcomes, and about how local stakeholders shape their livelihoods after the departure of aid agencies. We hope to help fill these gaps by using a large qualitative dataset collected between 2013 and 2016 in post-tsunami Aceh to assess the extent to which livelihood assistance programs helped to stabilize household economic security, helped people resume their pre-tsunami livelihoods, increased the economic productivity of pre-tsunami livelihoods, and encouraged persons without pre-tsunami livelihood experience to enter the productive economy.

## 2. Conceptual framework

We assess livelihood aid programs based on three categories of post-disaster livelihood assistance defined by the UNDP and the IFRC: livelihood provisioning, livelihood protection, and livelihood promotion [48,49] (Table 1). *Livelihood provisions* are short term measures to provide cash and consumables that households can use to manage their subsistence needs. This is essential to both resuscitate local markets and to limit the need for households to sell off productive economic assets out of desperation, thus leading to further economic deterioration.

*Livelihood protection* targets the restoration of pre-disaster livelihoods through replacing assets, capital and infrastructure lost in the disaster so that people can resume their pre-disaster livelihoods. Such programs generally involve mapping out the impact of a disaster upon livelihoods and providing aid to beneficiaries with pre-disaster livelihood experience.

*Livelihood promotion* aims to improve the overall economic situation of disaster affected persons through a combination of increasing the revenue generation potential of pre-disaster livelihoods, diversifying the range of livelihoods available, helping persons with pre-disaster livelihood experience transition to new (and more beneficial) livelihoods, and encouraging the entrance of people without pre-disaster livelihood experience into the productive economy. This latter step represents an ‘opportunity for combining disaster reduction and development interventions in one unifying approach’ [34], and is an example of linking reconstruction, recovery, and development.

We modify this terminology to make it more intuitive and self-explanatory. We refer to livelihood provision as *livelihood stabilization*, livelihood protection as *livelihood restoration*, and livelihood promotion as *livelihood development* (Table 1).

In this paper, we analyse qualitative data to assess the extent to which livelihood aid in post-tsunami Aceh contributed to livelihood stabilization, restoration, and development. Our analysis is shaped by the following questions:

- 1) Livelihood Stabilization: Were emergency aid packages consisting of food, other necessities, and cash transfers sufficient to help restart local markets and prevent tsunami survivors from selling stock and productive assets?
- 2) Livelihood Restoration: To what extent were livelihood protection packages able to help beneficiaries resume their pre-tsunami livelihoods? What were the main factors that facilitated or limited the successful resumption of pre-disaster livelihoods?
- 3) Livelihood Development: Did livelihood promotion programs increase the economic value and diversity of livelihoods available to tsunami survivors? To what extent did livelihood aid help bring people without pre-tsunami livelihood experience and vocational skills into the productive economy?

## 3. Research context and methods

The 2004 Indian Ocean tsunami caused horrific loss of life and destroyed much of the infrastructure and productive assets that supported the economy of affected coastal areas in Aceh, Indonesia [8, 30–34]. The tsunami destroyed more than half of the fishing fleet, two-thirds of fishery equipment, and more than three-quarters of Aceh’s harbours [35,43,50–53]. A combination of mechanical damage, salinization, and erosion disrupted agriculture and aquaculture [54–56]. The almost complete destruction of the built environment in the inundation zone wiped out infrastructure, assets, and stock needed for businesses and micro-enterprises, with over 100,000 small and medium enterprises destroyed [31]. The tsunami destroyed houses, personal possessions, killed livestock, and washed away cash and valuables, which caused an almost complete loss of household wealth for many tsunami-affected persons. The extreme loss of life significantly reduced local labor pools, disrupted networks of suppliers, producers, vendors and customers, and greatly reduced the accumulated body of productive skills available. In total, the tsunami caused \$4.5 billion USD in damages – equivalent to Aceh’s 2003 gross national product [57].

The post-tsunami humanitarian response was well funded and highly international [58,59]. The province of Aceh received about \$8 billion USD in humanitarian assistance [31,60] - and the number of NGOs operating in Aceh expanded from 13 to more than 300 [61]. Initial needs assessments and the Indonesian government reconstruction master plan stressed the importance of livelihood assistance to restore pre-tsunami activity and to use the reconstruction period to promote sustainable

**Table 1**  
Summary of key goals of types of post-disaster livelihood interventions.

	Goals	Objectives	Intended Beneficiaries	Types of Aid
<b>Livelihood Stabilization Stat</b>	<b>Stabilize</b> household livelihood and economic productivity.	Compensate for short-term loss of income and household assets/wealth Limit the liquidation of productive assets to satisfy pressing daily needs Limit the diversion of productive capital to satisfy pressing daily needs Inject liquidity into the local economy to resume markets	A wide range of beneficiaries irrespective of pre-disaster livelihood status or profession Such programs are generally NOT considered part of livelihood programs, but rather seen as general humanitarian assistance during the emergency phase	Provision of foodstuffs, water, and day-to-day necessities and basic commodities Cash transfers Cash-for-work programs
<b>Livelihood Restoration</b>	<b>Restore</b> pre-disaster livelihoods.	Restoration of pre-disaster livelihoods	People involved in specific livelihoods pre-disaster	Replacement of physical capital, productive assets, and stock/inventory lost during the disaster Access to capital through grants and micro-credit programs Restoration of physical infrastructure necessary for livelihood functioning
<b>Livelihood Development</b>	<b>Develop</b> new forms of livelihoods and increase economic potential of disaster affected-persons.	Improve the economic situation of pre-disaster livelihood actors Increase available scope of economic opportunity Encourage the entrance of new livelihood actors	Persons with pre-disaster livelihood experience Persons without pre-disaster livelihood experience	Provision of productive assets Provision of supplies, ingredients and stock Provision of capital through grants and micro-credit programs Training and capacity enhancement (vocational, business, and financial literacy) Upgrading/providing new physical infrastructure to support livelihood expansion or enhancement

development [35,36].

Basic economic assistance packages were widely distributed during the emergency phase to help households manage costs of living (livelihood stabilization). Additional livelihood assistance was provided to restore pre-tsunami livelihoods (livelihood restoration), and encourage the expansion of livelihood opportunities available, especially for persons without prior livelihood involvement (livelihood development). While every donor and implementing agency had a distinct approach, most programs broadly utilized some combination of cash-for-work to clear land and rebuild infrastructure, replacement/provision of physical productive assets and stock, access to financing through grants and micro-credit, and vocational and small business management training.

Beneficiary selection initially targeted restoring pre-tsunami livelihoods (livelihood restoration), but expanded greatly in scope, reflecting shifting donor priorities to reduce economic vulnerability and incorporate women and potentially marginalized groups of stakeholders more fully into the productive economy (livelihood development) (Table 2).

The data presented in this paper includes qualitative data collected between 2013 and 2015 and GIS analysis of 88 villages within three distinct zones (Fig. 1). Zone 1 includes the area around the city of Banda Aceh, which was both heavily damaged and the main administrative center of the province (and the reconstruction efforts); Zone 2 is a large rural area approximately 50 km south of Banda Aceh; and Zone 3 is the administrative center of the province surrounded by rural areas

**Table 2**  
Summary of the main kinds of livelihoods supported by post-tsunami livelihood assistance programs in the three case study zones. This data was sourced from the RAND database, established by the Indonesian government to account for all post-tsunami aid projects in Aceh and Nias.

Sector	Livelihood Activities	Types of Aid
<i>Agriculture</i>	Rice cultivation, tree crop plantations (coconut, palm, pepper, durian, etc.), household gardens.	Cash-for-work to clear rice fields and rebuild field boundaries and water management infrastructure; provision of tools, equipment and fencing; provision of seed stock, training and capacity to enhance agricultural yields; formation of farmer cooperatives.
<i>Aquaculture</i>	Fish and prawn pond cultivation.	Cash-for-work to clear ponds and rebuild water management infrastructure; provision of seedlings; loans; training and capacity building to increase yields; introduction of new species and aquaculture techniques.
<i>Fisheries</i>	Off shore fishing, mainly using boats.	Provision of equipment for fishing, including but not limited to boats, nets, hooks, line, and fish processing equipment. Fisher cooperatives. Communal infrastructure such as docks, fish processing plants, and fish market.
<i>Livestock</i>	Small-scale livestock rearing for personal consumption and/or sale.	Provision of small numbers of animals (goats, cows, ducks, chicken, etc.), or funds to purchase animals, for some combination of breeding and/or fattening.
<i>Micro-Enterprises – home production</i>	Production of consumables and consumer products, either in small shops, or at home. This includes, but is not limited to, cake baking, bakeries, basket weaving, clothes making, textile weaving, and brick making -	Provision of tools, infrastructure, and supplies/ingredients. Vocational and business management training programs. Loans and grants.
<i>Micro-Enterprises – service</i>	Individuals or groups providing services – including, but not limited to, mechanics, tailors, pedicab drivers, electronics repairmen etc. Neighborhood shops such as coffee shops, grocery stores, electronic shops, petrol and phone top up kiosks, etc.	Provision of equipment and tools, either directly through asset provision or through grants and loans. Vocational and business management training programs.

(Table 3).

In a sample of 37 villages in the three zones, our researchers conducted 25 key informant interviews with village leaders [23 male and 14 female respondents]; 15 interviews with former staff members of NGOs that oversaw livelihood projects [11 male and 8 female respondents]; 143 interviews with beneficiaries of livelihood programs [123 male and 101 female respondents]; and 38 focus group discussions about the impact of aid at the village level [128 male and 159 female respondents] (see Supplementary Online Materials). In total, our interviews and FGDs involved 285 male and 282 female stakeholders. All of the interviews and FGDs were semi-structured. We do not claim that our data are statistically representative. However, we structured our approach to balance the perspectives of livelihood aid beneficiaries for each sector, with the perspectives of village leadership and Acehnese who worked for

NGOs to provide livelihood assistance. We completed enough interviews and FGDs to reach a point of saturation for all sectors and themes covered by our survey.

Interview subjects were chosen by our research team with the help of local village facilitators to provide a mix of male and female respondents and provide representation of different types of livelihood. All interviews were conducted by a team of Acehnese field researchers that were trained and employed by our project, and most of the interviews and FGDs were supervised in the field by at least one of the authors. All interviews and FGDs were conducted in either Indonesian or Acehnese, transcribed by members of our research team in Indonesian and English, and coded and analysed by the authors using MAXQDA.

We sorted and aggregated the qualitative data by livelihood sector [agriculture, aquaculture, fisheries, livestock, and micro-enterprise] and

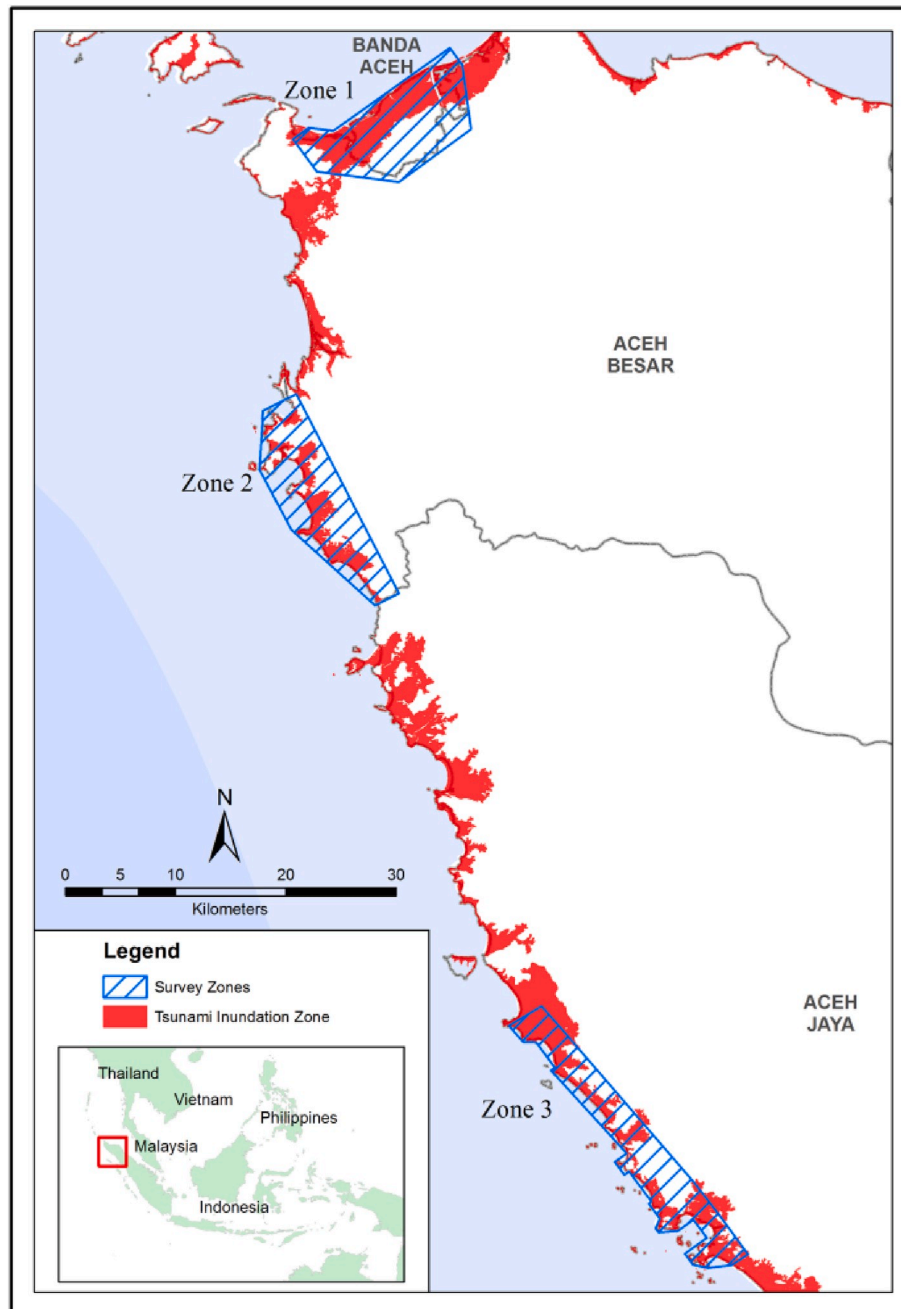


Fig. 1. Map of the north coast of Aceh province, Indonesia. The red indications areas flooded by the 2004 Indian Ocean tsunami. Our three case study zones are indicated by the blue hatched areas. (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.) (Map after Daly et al. 2017).



**Table 3**

Breakdown of post-tsunami aid in USD spent in each of the study zones, based upon the data in [Supplementary Tables 1–3](#). This data was sourced from the RAND database, established by the Indonesian government to account for all post-tsunami aid projects in Aceh and Nias. We analysed aid provided for a total of 88 villages in the three zones. We randomly sub-sampled 37 villages where we conducted interviews and FGDs. In the first column in the table we include the total number of villages in the survey areas (first number) and the number of villages we sub-sampled for interviews (second number).

Zone	Zone Characteristics	Number of Livelihood Projects	Small Business	Agriculture	Aquaculture Fisheries	General Economic Infrastructure	Other	Total
Zone 1 Villages: 52/26 FGDs: 25 KII: 156	Densely populated city of Banda Aceh and periphery. Main pre-tsunami livelihoods: small businesses, informal day labor, government civil service, fisheries, rice cultivation. Coastal villages engaged in aquaculture.	65	6,686,677	1,915,234	5,326,798	15,121,886	160,774	29,211,369
Zone 2 Villages: 21/5 FGDs: 7 KII: 12	Lightly populated narrow coastal plain with small villages separated from major markets. Main pre-tsunami livelihoods: rice cultivation, tree-crop plantations, fishing, aquaculture.	17	943,056	5,057,235	520,524	109,238	23,420	6,653,473
Zone 3 Villages: 15/6 FGDs: 6 KII: 15	Moderately populated coastal plain with a small town serving as administrative center of the Aceh Jaya district. Main pre-tsunami livelihoods: government civil servants, small business, rice cultivation.	16	428,323	3,551,258	28,396	1,310,705	333,456	5,652,139
Total			8,058,056	10,523,727	5,875,718	16,541,829	517,620	41,516,981

by aid distribution mechanism [grants and loans, cash for work, asset replacement, training and capacity building]. This data was then analysed to determine the patterns of livelihood outcomes presented in this paper. We conducted GIS spatial analysis in the three zones to calculate the net changes in land used for rice cultivation and aquaculture prior to the tsunami, just after the tsunami, and following the end of the reconstruction period, as reported in more detail in Daly et al. [54].

We used data from the RAND database, created by the Indonesian Reconstruction Agency, to account for donations and project progress, to analyse the broad patterns of aid distribution by livelihood sector, aid distribution mechanism, and locale (Online [Supplementary Table 1–3](#)). Our data do not allow for a detailed quantitative assessment of aid outcomes on a project by project basis, in part because of holes in the data self-reported by implementing NGOs and donors, and in part because of respondent recall limitations during the interviews conducted years after receiving aid. Therefore we restrict ourselves in this paper to providing a ‘big picture’ analysis of overall aid effectiveness across five key sectors that received the majority of livelihood assistance. Our assessment is a product of our review of an extensive set of qualitative data and is informed by our collective years of experience operating in post-tsunami Aceh as researchers and practitioners.

In the results section we first discuss the impact of aid used to stabilize household finances and then move on to more substantial discussions about livelihood restoration and development efforts. For each livelihood sector we discuss tsunami impacts and aid received. We then present a summary of the key livelihood outcomes as reported by our respondents. Finally, we provide a table of the main factors that limited the effectiveness of livelihood restoration and/or development initiatives. We identify the sources for all of the data we present by using respondent codes that are linked with a table in the online supplement that provides information about our interviews while preserving the anonymity of our respondents.

## 4. Results

### 4.1. Livelihood stabilization

Cash, material transfers, and cash-for-work programs formed a critical resource for households during the early phase of the reconstruction. Much of the cash obtained through these mechanisms was used to meet personal and/or household needs such as food, clothing, temporary accommodation, school fees, household expenses, mobile phone credit, and transportation. This funding was important to help tsunami

survivors obtain necessary products, gain a small measure of control over their lives, and support initial restoration of local markets. Cash was spent mainly in kiosks and vendors around temporary shelters/barracks and markets and vendors outside of the tsunami inundation zone (especially for urban areas like Banda Aceh where considerable commercial infrastructure was functioning). For the most part, such cash transfers were not used to restore or develop livelihoods.

The scale of devastation caused by the tsunami left few survivors with any productive assets, therefore it was not possible for most people to sell off pre-tsunami productive assets. However, it was common for people to sell off or divert new productive assets, stock and capital obtained after the tsunami from livelihood aid programs. They diverted this aid to meet pressing day-to-day needs and purchase consumer products. The liquidation and/or diversion of capital and assets continued during the first three years after the tsunami and most likely had negative impacts on economic productivity and limited the effectiveness of donor-supported livelihood restoration and development projects.

### 4.2. Livelihood restoration and development

#### 4.2.1. Rice cultivation

Agriculture constituted a major component of Aceh’s pre-tsunami economy, accounting for a third of GDP and employing almost half the labour force [36]. Rice cultivation was present in all three zones before the tsunami and played a particularly important role in Zone 2, our most rural study area. The tsunami caused extensive damage irrigation canals, field boundaries, fencing, access paths, tools, seed stock, fertilizer and human resources (through mass loss of life). The inflow of seawater contaminated the soil and ground water [50,55,56]. Fields were covered in mud and debris, including broken glass, sharp bits of metal, wire, and other potentially dangerous items.

Donor and government funded programs supported the physical rehabilitation of rice fields (clearing debris, rebuilding field barriers and water management features, reconnecting roads and paths – largely through cash-for-work programs),<sup>1</sup> provision of technical assistance (assessing levels of salinization, new farming techniques, etc.)<sup>2</sup>, and provision of productive assets and small amounts of capital (tools, seeds, fertilizer, fencing)<sup>3</sup> [31,37,38,50]. The overall motivation of the aid was to rehabilitate as much of the pre-tsunami agricultural land as possible (livelihood restoration), with some efforts made to enhance yields, build systemic resilience by introducing new types of crops which are faster growing and/or better adapted to sea water inundation, and introduce

**Table 4**

The main challenges that limited the restoration of rice cultivation and development initiatives within the agriculture sector.

Factor	Livelihood Approach Impacted	Description
Land Repurposing	Restoration	In some areas, heavy damage to pre-tsunami residential and commercial land required using pre-tsunami agricultural land for reconstructing domestic and commercial structures. Around the city of Banda Aceh, large tracts of pre-tsunami rice fields outside the inundation zone were developed for residential use, fuelled in part by tsunami-affected persons moving away from the coast [62].
Mechanical Damage	Restoration	A combination of tsunami erosion and post-seismic subsidence caused extensive and often irreparable damage to fields, irrigation canals, and associated infrastructure. <sup>9</sup>
Loss of Labor	Restoration; Development	High tsunami-mortality rates reduced the amount of people working in rice cultivation and sometimes led to situations where the person inheriting land lived outside of the village and did not utilize the land. <sup>10</sup>
Diversion of Labor	Restoration; Development	New short-term forms of work during the reconstruction period such as construction and providing support for NGOs, coupled with the availability of donor-supported livelihood programs which often provided cash or material benefits to encourage participation diverted labor from farming. <sup>11</sup>
Inappropriate or Inadequate aid	Restoration; Development	Farming tools were broken, sold, and/or distributed to persons lacking the interest/capacity to effectively utilize them. Implements not familiar before the tsunami were often under-utilized and/or poorly maintained. <sup>12</sup>
Inefficient targeting and allocation of aid	Restoration; Development	Assets and aid provided to persons without pre-disaster experience were often not efficiently utilized and commonly transferred or sold to others. Assets provided to collectives were often unaccounted for or not used efficiently. <sup>13</sup>
Land Ownership	Development	Rice farming was generally only feasible for beneficiaries with agricultural land making lack of land a high barrier to entry into the sector. We did not encounter any aid projects that supported land redistribution to provide arable land to encourage new farmers.
Conservative Techniques	Development	Farmers generally reverted to standard pre-tsunami farming methods, which negated efforts to diversify crops, introduce more resilient species, and increase yields.

more diversity to the range of agricultural products (livelihood development)<sup>4</sup>.

We found that the provision of heavy earthmoving equipment and extensive cash-for-work programs were instrumental in clearing fields and rebuilding water-management infrastructure. Within a year after the tsunami a combination of clearing debris and rainfall reduced salinity levels so that cultivation was possible. The highest rates of rehabilitation occurred in areas where rice farming was the primary source of livelihood before the tsunami and there were limited alternative livelihood options created during the reconstruction period, such as in Zone 2<sup>5</sup>. In villages which had higher rates of rice field rehabilitation, respondents reported that village leaders encouraged resumption of rice cultivation. In several villages, leaders created incentives to encourage farmers from outside of the village to clear and productively use damaged rice fields<sup>6</sup>.

However, our analysis of satellite images shows that a decade after the tsunami only 45% of pre-disaster rice fields were in cultivation in our three study zones [54]. This provides a measurable quantity for the amount of restoration that occurred and shows that at best aid was able to support a partial restoration of pre-tsunami rice cultivation. The main factors limiting restoration were large-scale land repurposing for new developments and the irreparable physical damage caused by the tsunami, erosion, and related subsidence caused to rice fields and associated infrastructure. A combination of high injury and mortality rates and alternative employment opportunities during the reconstruction period limited the labor available to resume cultivation. It was common for people who inherited farm land after the tsunami to either not live near the village and/or not be interested in farming. Finally, in some cases respondents reported that the aid provided was insufficient, inappropriate, of too low quality to use effectively, or provided to people who were not farmers (see Table 4 for details). Fields that were not quickly rehabilitated became overgrown, fallow and a breeding ground for pests that negatively impacted the productivity of surrounding fields<sup>7</sup>.

We found that post-tsunami aid was generally not successful for livelihood development in the agriculture sector. There is little indication that aid supported the entrance of people into farming that were not farmers before the tsunami. While technical advice was welcomed by pre-tsunami farmers, we found that few farmers adapted new techniques or species. However, the construction of new bridges and roads made it easier for farmers to transport crops to market<sup>8</sup>. The main impediments to the development of rice cultivation were the poor quality of aid, ineffective allocation of aid, lack of land ownership, and limited

interest/ability to use new techniques (Table 4).

#### 4.2.2. Aquaculture

Before the tsunami, aquaculture production across Aceh employed 94,000 people across 47,000 ha of fishponds and accounted for 3% of the provincial economy. Aquaculture was an important component of Acehnese livelihoods for many coastal communities, especially around the city of Banda Aceh in Zone 1. Erosion, subsidence, coastal deformation, soil/water contamination, and widespread debris caused by the tsunami disrupted aquaculture. Almost half Aceh's fish ponds were heavily impacted [50], with damage to the aquaculture sector estimated at \$35 million USD [31,36].

Donors funded cash-for-work programs and provided mechanical diggers to clear debris and rebuild fish pond infrastructure<sup>14 & 15</sup>. Assets, including fish seedlings, tools, fencing and other equipment were provided<sup>16</sup>. In some cases, training and capacity building programs were organized in conjunction with the Aceh government<sup>17</sup>. Modest amounts of capital were made available through small grants and micro-finance programs to help beneficiaries purchase fish stock, feed, and other supplies<sup>18</sup>. Livelihood development aid was provided to increase the productivity and yields of fish ponds through the introduction of new species and cultivation techniques and enhance the value chain of aquaculture through the development of down-stream processing and market infrastructure.

We found that pre-tsunami fishers benefitted from the provision of heavy earthmoving equipment and extensive cash-for-work programs to dredge fish-ponds and rebuild water-management infrastructure. Additionally, provision of fish stock and financing helped some fishers resume aquaculture. However, our analysis of satellite images shows that a decade after the tsunami, only 66% of the pre-tsunami fish ponds were in cultivation in our three study zones [54]. This indicates that at most aid was only able to help support a partial restoration of the sector. We found that the main factor limiting the restoration of aquaculture was the physical damage caused by the tsunami to fish ponds and canals. In many areas the environment was too heavily degraded to rehabilitate – or to rehabilitate with the levels of aid that were available. Our respondents reported that people who tried to resume cultivation commonly ran into problems when their stock died off, or that they did not reinvest the revenue from their initial harvest into subsequent crops. (See Table 5). It was common to hear that people used aid to clear their ponds, start an initial crop of fish, but then stop because they lacked the capital to fund subsequent crops.

We did not encounter any cases where persons without pre-tsunami

**Table 5**  
The main challenges limiting the restoration and development of aquaculture.

Factor	Livelihood Approach Impacted	Description
Lack of Capital	Restoration; Development	Many beneficiaries lacked the capital needed to fund additional harvest cycles because they were unable to generate revenue because of initial crop failure, prematurely sold their stock to obtain cash, or diverted revenue from successful harvests to pay for household needs and/or purchase consumer products. <sup>21</sup>
Mechanical Damage	Restoration; Development	A combination of tsunami erosion and post-seismic subsidence caused extensive, and often irreparable, damage to ponds and water management infrastructure. In some cases aid packages were not sufficient to fully rehabilitate fish ponds. Lack of access to heavy earth moving equipment was a major limitation as clearing ponds by hand was both very difficult and often dangerous due to harmful debris mixed into the sediment. <sup>22</sup>
Loss of Labor	Restoration; Development	High tsunami-mortality rates and availability of other forms of employment during the reconstruction period reduced the amount of people and interest in working in aquaculture.
Stock Die-off	Restoration; Development	Beneficiaries reported that fish stock died off because of 'diseases' that many respondents attributed to chemical and/or biological changes caused by the tsunami. <sup>23</sup>

aquaculture experience used livelihood assistance to start up fish ponds during the reconstruction period. However, the introduction of new species and techniques did help some pre-tsunami fishers adjust to the ecological changes caused by the tsunami and cultivate fish with faster harvest cycles and higher market value<sup>19</sup>. Investments in downstream infrastructure such as markets and fish processing facilities seems to have increased the value of fish stock and created additional employment within the overall fishery industry in Banda Aceh<sup>20</sup>. There was an increase in the number of fish ponds after the end of the reconstruction period, but most of this was supported by private capital and not related to post-tsunami aid [54].

4.2.3. Fisheries

The fisheries sector in Aceh was a major source of employment before the tsunami, comprising at least 100,000 people, with about 58,000 full-time fishers, and accounting for 3.5% of provincial GDP [31, 36,44]. Fishing was mostly artisanal and an important sustenance and livelihood activity for many coastal communities. The tsunami destroyed fishing boats, equipment, docks, processing facilities and markets. Between 10 and 20% of the fishing workforce was killed [35, 43,44,50–53].

Aid was provided by a combination of donors, NGOs and Indonesian government departments. Aid largely consisted of asset provision, dominated by fishing boats, nets, hooks, and other supplies<sup>24</sup>. In some cases, organizations provided block grants so beneficiaries could buy needed equipment<sup>25</sup>. Donors supported the construction of a fish processing plant, an ice factory, and docks<sup>26</sup>. Finally, efforts were made to form fisher collectives and to provide capacity building programs to improve the business skills of fishers.

A decade after the tsunami, we found that fishing has resumed being an important industry for coastal communities, with some evidence for the development of the industry through expansion of fish processing and export. However, we feel that this resumption was shaped more by

private investment after the end of the reconstruction period than the extensive packages of livelihood assistance provided for this sector, but we cannot verify this empirically with our data. We do know that many fishers used some of the assistance provided to resume fishing. However, many respondents also reported significant issues with the types and quality of assets provided which limited the effectiveness of aid. Many aid boats were not safe or suitable for local fishing conditions. There was a misalignment between aid and pre-tsunami fishing practices as donors funded wide-scale distribution of small fishing boats to individual fishers (many of whom did not own a boat before the tsunami) and generally did not provide support for the larger types of ships that were important in the pre-tsunami fishing fleet. To a lesser extent, resumption was slowed by the diversion of aid and the availability of other employment opportunities during the reconstruction (Table 6).

We found little evidence that non-fishers entered into the sector as a result of aid and encountered no obvious indication of increased yield productivity of fishers due to livelihood assistance. Efforts to increase equity by providing boats to people who did not own their boats before the tsunami were met with only limited success. We did find indications for modest increases in the value and employment in the fishery sector from infrastructure upgrading. The main impediments for livelihood development in the fishing sector were the poor quality of aid, provision of aid to people with no interest in fishing or as part of collectives that included people with no interest in fishing, and availability of other employment opportunities (Table 6).

4.2.4. Livestock

The tsunami killed large numbers of livestock (cows, goats, ducks, chickens, buffalo, etc.) that were important pre-tsunami sources of food, household wealth and labor. Both livestock restoration and development programs provided small numbers of animals<sup>33</sup>, funding for beneficiaries to purchase animals<sup>34</sup>, and technical and veterinarian support such as vaccinations, vitamins, and artificial insemination<sup>35</sup>. Most

**Table 6**  
The main challenges that limited the restoration of fishing and development initiatives within the fishing sector.

Factor	Livelihood Approach Impacted	Description
Poor Quality of donated assets	Restoration; Development	Beneficiaries reported that many aid boats were poorly constructed and/or made from low quality materials making them unsafe or impossible to use. <sup>27</sup>
Misaligned Aid	Restoration; Development	1. Aid boats were not of the right design for use in Aceh's offshore waters. <sup>28</sup> 2. There was a donor emphasis on providing large numbers of small boats to individual fishers, whereas the pre-tsunami fishing sector consisted of fishers who worked as crew on larger boats. Not everyone in the sector was interested in becoming, qualified to be, or had access to sufficient skills and capital to serve as a boat captain. 3. The provision of aid boats to arbitrary collectives caused confusion, waste and tension over how to share physical assets, as well as resentment from those who worked hard about having to share their catch with others in their groups whom they perceived did not earn it. <sup>29</sup> 4. Boats and other fisher aid were provided to people with no interest in fishing. <sup>30</sup>
Diversion of Aid	Restoration; Development	Beneficiaries sold good boats and other forms of fisher aid to obtain cash for day-to-day expenses such as food, housing, education, and medical expenses. <sup>31</sup>
Alternative Employment Opportunities	Restoration; Development	Demand for physical labor and the range of donor-supported livelihood programs during the reconstruction diverted people away from the fishery sector. <sup>32</sup>



**Table 7**

The main challenges that limited the restoration of livestock and development initiatives within the livestock sector.

Factor	Livelihood Approach Impacted	Description
Diversion of Aid	Restoration; Development	Beneficiaries liquidated breeding or fattening stock for personal consumption or to obtain cash for household needs and/or to purchase consumer products. <sup>39</sup>
Lack of Facilities in temporary settlements	Restoration; Development	The temporary domestic spaces during the reconstruction period were often not suitable for rearing stock because of lack of pens and facilities for animal storage, limited accessibility of grazing land, the density of the human population living within a site, and the inconvenience caused by the noise and smell of the animals. <sup>40</sup>
Lack of Commitment	Restoration; Development	Some beneficiaries lacked the time and interest to manage stock – especially if they were dealing with more pressing reconstruction concerns/activities or participating in alternative livelihoods during the reconstruction period. Persons without pre-tsunami experience with livestock often underestimated the time and effort needed to successfully rear animals and especially how much effort it takes to constantly find grazing areas for goats and cows. <sup>41</sup>
Stock Die-off	Restoration; Development	Stock provided were lost or killed (disease, auto accidents, etc.) before beneficiaries could breed them or otherwise obtain value. <sup>42</sup>

programs were designed so that beneficiaries could either breed aid animals to increase their stock until they had a viable herd and could begin to liquidate animals for sale or personal consumption, or so that beneficiaries could fatten up younger animals, sell them, and use part of the proceeds to buy new young animals, thus repeating the process.

Livestock aid was widely appreciated by most respondents. Many beneficiaries with pre-tsunami livestock were able to maintain modest stock of animals through breeding and selective liquidation – effectively restoring their pre-tsunami state<sup>36</sup>. However, it was common for people to gradually reduce their stock – often for personal consumption or to obtain funds for household expenses. We found very few cases where people were able to significantly increase their stock and as such livestock aid was largely successful as a supplementary source of occasional income and/or subsistence, rather than a livelihood that produced sufficient income to support a household. The main impediment to restoring livestock or scaling up breeding operations was the diversion of aid to pay for immediate needs. Additionally, respondents reported that they lacked adequate pens and facilities within temporary housing complexes and so it was difficult to rear stock prior to moving into permanent housing. Finally, many people reported that their animals died due to disease, neglect and auto accidents (Table 7).

We found that a significant number of beneficiaries who didn't have livestock before the tsunami were able to maintain small numbers of stock through breeding and selective liquidation<sup>37</sup>. However, many beneficiaries were not able to maintain their stock past the end of the reconstruction period and very few beneficiaries were able to scale-up commercial breeding enterprises<sup>38</sup>. The failures of people without pre-tsunami livestock are similar to those with stock prior to the tsunami. This is the one sector where we did not get the impression that pre-disaster experience was a major influence of outcome.

#### 4.2.5. Micro-enterprise

Given the informality of the micro-enterprise sector in Aceh, it is difficult to get an accurate accounting of damage caused by the tsunami to micro-enterprises. According to some estimates, up to 100,000 micro- and small-enterprises were disrupted by the tsunami [31,36]. Regardless of exact numbers, it is clear that the tsunami caused massive reduction of the human capital, physical assets and infrastructure, and networks of customers and suppliers needed for micro-enterprises to function. Additionally, large numbers of households lost their homes and wealth and were displaced to various kinds of temporary accommodation for periods of up to three years, which affected the many pre-tsunami micro-enterprises that were carried out on peoples' property. The years immediately following the tsunami were characterized by extensive economic disruption and uncertainty which posed severe challenges to restoring micro-enterprises.

Micro-enterprise aid was provided for a wide range of professions spanning the retail, production and service sectors. The main kinds of aid were productive assets (tools, sewing machines, etc.)<sup>43</sup>, stock, materials and supplies<sup>44</sup>, capital (through grants and micro-credit

programs)<sup>45</sup>, and capacity building (through vocational and business management training)<sup>46</sup>. It was common for aid to be distributed to groups of beneficiaries, often requiring beneficiaries to share or co-manage productive assets, or manage financing through 'revolving fund' loans<sup>47</sup>. Micro-enterprise programs varied in duration and intensity of monitoring and evaluation.

Initially, support for micro-enterprises targeted restoration of pre-tsunami businesses, favouring beneficiaries involved in micro-enterprises before the disaster<sup>48</sup>. This was done through a combination of needs assessment, soliciting proposals from pre-tsunami business persons, and working with local government offices and village elders to identify people by pre-tsunami profession and level of experience.

As funding became widely available and as donor and NGO mandates shifted to include a more expansive focus on developing livelihoods, micro-enterprise programs were scaled up and made available to people without experience running businesses before the tsunami<sup>49</sup>. This was especially the case for women, who received significant amounts of support for micro-enterprises, especially ones that involved monetizing activities associated with the domestic sphere, such as sewing, embroidery, cooking and cake baking<sup>50</sup>. Aid to support livelihood development within the micro-enterprise sector had three goals: 1) to support the development of micro-enterprises by persons without pre-tsunami micro-enterprise experience; 2) to increase the economic productivity of micro-enterprises run by people with pre-tsunami micro-enterprise experience; and 3) to diversify the range of micro-enterprises in Aceh beyond the scope of pre-tsunami enterprises.

We found that aid helped many of our respondents restore their pre-tsunami micro-enterprises<sup>51</sup>. We estimate that over half of our respondents with pre-tsunami micro-enterprise experience received some benefit from micro-enterprise assistance<sup>52</sup>. Providing capital and assets allowed proprietors of small retail shops and food kiosks to restart their businesses. Provision of tools and capital helped skilled craftspersons such as mechanics, bakers, and tailors get back to work. Most successful restoration of micro-enterprises occurred after the provision of permanent housing (between 1 and 3 years after the tsunami).

However, many people with pre-tsunami micro-enterprises were not able to restart and/or sustain their businesses. This was in part a function of the extreme levels of disruption to markets, infrastructure and facilities. High mortality and dislocation rates dramatically reduced the customer base and demand within heavily damaged areas. Additionally, many respondents reported that they had to divert aid and revenue generated from their businesses to pay for immediate household needs (and also less essential consumer products). Finally, micro-enterprise programs generally did not provide support to rebuild the physical infrastructure needed for people to successfully resume business operations such as kiosks, shops and production facilities (see Table 8).

We found that few beneficiaries without pre-tsunami experience were able to develop sustainable micro-enterprises that were sufficient to support a household. Once aid stopped at the end of the reconstruction period, many micro-enterprises started by beneficiaries without

pre-tsunami experience stopped or scaled down dramatically<sup>53</sup>. We encountered many beneficiaries who tried to set up a full-time micro-enterprise, failed, and ended up working on an ad-hoc or part time basis – often based upon orders received, or for more experienced persons<sup>54</sup>. This was a common outcome for women who lacked pre-disaster livelihood experience and provided useful additional income<sup>55</sup>. The most successful groups of people without pre-tsunami livelihood experience were widows with young children to care for, or women whose husbands were no longer capable of earning sufficient income.

One of the main obstacles preventing the development of micro-enterprises was lack of vocational and business skills – even for people who participated in donor-supported training and capacity building programs. In simple terms, such programs were not sufficient in scope and design to get people to a level of skill where customers would pay for their services or products. Many respondents struggled to manage the financial aspects of their business. The large number of participants within similar livelihood development programs created a surge of people all trying to start up and maintain the same kinds of businesses within the same areas at the same time. This supply generally exceeded local demand. Many beneficiaries diverted micro-enterprise development aid to pay for household needs and purchase unproductive consumer products. Respondents also reported that it was difficult to start up and maintain a micro-enterprise because of personal trauma, dislocation, diversion of labor, market misalignment, and domestic pressures (Table 8).

### 5. Discussion

Significant efforts were made by donors and NGOs to provide comprehensive and integrated livelihood assistance packages across tsunami affected areas. This aid aimed to restore pre-tsunami livelihoods and promote new economic opportunities. Given the wide range of projects, donors and implementors, and beneficiaries, it is no surprise that the range of outcomes is equally wide. However it is possible to identify broad trends in livelihood outcomes.

It is important to first acknowledge that there are a number of limitations to our study that could affect our results, interpretations, and recommendations. While we are comfortable that our data accurately captures the overall dynamics of livelihood assistance in our study zones, our sample is not statistically representative. Given that aid was not distributed evenly by the same organizations across all tsunami-affected areas, it is likely that our data do not account for all possible experiences and outcomes. When analysing our data, we encountered a wide range of personal experiences, perspectives, and outcomes. In our summaries we focus on presenting what we feel are the most common and representative narratives of aid distribution and utilization based upon the relative frequency of mention by respondents, and by triangulating responses from different categories of stakeholders (aid recipients, NGO workers, village leaders, etc.). Because we conducted research almost a decade after the tsunami, we faced issues with respondent recall. While we do not feel that this changes the overall narrative, it limits our ability to provide precise assessments of aid

**Table 8**  
The main challenges that limited restoration and development of micro-enterprises.

Factor	Livelihood Approach Impacted	Description
Market Disruption	Restoration; Development	The severe disruption of markets, supply chains and customer base in the first three years after the tsunami made it difficult for people to pick up where they were right before the tsunami. During the first three years of the reconstruction the basic conditions that allowed for sustainable operations before the tsunami did not exist. Additionally, the 'new normal' after the reconstruction period was not always conducive for restoring micro-enterprises if people could not adapt.
Lack of Infrastructure Temporary displacement	Restoration; Development	The completion of permanent housing commonly took between one and three years. This was a major impediment for people who had based their pre-tsunami micro-enterprises out of their homes. This extended temporary flux made it difficult for micro-enterprise proprietors to have a stable customer base with reliable purchasing power.
Trauma and Dislocation	Restoration; Development	The extensive personal trauma caused by the tsunami and the disruption caused by life in temporary accommodation made it difficult for some to concentrate on their micro-enterprises, making some especially vulnerable to even relatively minor set-backs or failures.
Aid Diversion	Restoration; Development	Livelihood assistance and/or revenue was often diverted to pay for daily household needs and/or non-productive, non-essential items. This limited the ability of people to fund and/or reinvest in their micro-enterprise. <sup>56</sup>
Inappropriate or Inadequate aid	Restoration; Development	Assets were commonly provided to people who lacked the skills to productively use them, or had no interest in using them. In some cases, the assets provided were not suitable for livelihoods, or were expensive/difficult to operate and maintain. The limits of capital provided from grants and loans was often too small to be useful when setting up a micro-enterprise.
Tensions with Collective Aid	Restoration; Development	Aid packages were commonly given to groups, both in terms of physical assets to be shared and capital as part of micro-credit funds. Aid provided to groups led to tensions about sharing, ownership, distribution of profits, and obligations to re-pay. <sup>57</sup>
Lack of Capital	Restoration; Development	The lack of access to short-term operational capital to produce orders, carry out services, etc. Prior to receiving full payment made it difficult for people in marginal economic situations to sustain or expand operations. <sup>58</sup>
Diversion of Labor	Restoration; Development	The diversion of labor because of economic opportunities created during the reconstruction including construction, working for NGOs, and participating within donor supported alternative livelihood programs shifted some people away from their pre-tsunami micro-enterprises.
Inadequate Skills	Development	Few beneficiaries who participated in short-term vocational training programs (such as sewing, cake baking, electronic repair, etc.) were able to obtain professional quality skill sets necessary to be successful. <sup>59</sup>
Market Misalignment	Development	The large numbers of participants within micro-enterprise programs created high levels of competition within a few sectors in small geographic areas. This flooded markets with people with similar (remedial) skill sets, business plans, and aid packages, often training more beneficiaries than local markets could reasonably support. <sup>60</sup> Efforts to introduce new products and services that were not common in Aceh before the tsunami often failed to appreciate local market demand, the function of supply chains, and whether producers in Aceh had a comparative advantage in making certain products (for example, there were programs to introduce batik textile manufacturing, but there was not extensive demand in Aceh for batik, and local producers could not compete in the export market with long-established producers based elsewhere in Indonesia or overseas).
Domestic Pressures	Development	There were explicit efforts to use micro-enterprises and micro-credit programs to create economic opportunities for woman who were not formally employed before the tsunami. However, it was common for women, including many who were serious about trying to set up a micro-enterprise, to struggle to balance their domestic responsibilities with managing the micro-enterprise. <sup>61</sup>

outcomes for specific livelihood projects. Finally, while we were able to track down and interview Acehese NGO workers, it was not possible within the scope of our study to interview external aid actors who played instrumental roles designing and implementing livelihood assistance programs during the reconstruction. Our main sources of data from implementors comes from project concept notes and reports, both of which were produced by aid organizations. With these caveats noted, we now present a summary discussion of our key findings.

*Livelihood Stabilization:* Emergency cash transfers and cash-for-work programs provided a vital lifeline for households immediately after the tsunami. This allowed beneficiaries to manage their needs, partially offset their lack of income, and start to resume their lives. This capital infusion helped to revitalize local markets and facilitate clearing rubble and other communal projects. However, the funding available was not sufficient to prevent the liquidation of productive assets – the primary goal of livelihood stabilization. While few people had productive assets that survived the tsunami, it was common for beneficiaries to sell or exchange productive economic assets received from livelihood programs, and/or divert capital and revenue to obtain cash for day-to-day needs or purchase non-productive consumer assets. This diversion of livelihood assistance most likely reduced the economic impact of livelihood programs.

*Livelihood Restoration:* Livelihood aid helped many beneficiaries to restore pre-tsunami livelihoods, especially when aid packages replaced lost or damaged assets with similar assets and provided capital. However, there were clear limits to what could be restored. While aid packages generally contained a sensible mix of capital and assets, in some sectors (such as fishing) the poor quality and design of aid limited restoration. Additionally, the artificial and often arbitrary groups that donors and NGOs widely used to increase distribution efficiency failed to align with how livelihoods actually function, neglected to leverage the strengths of local authorities (formal and informal), and created unnecessary waste and tension. The scale of disruption to local markets, infrastructure, supply chains, and customer bases caused by the disaster were often insurmountable – irrespective of aid. The conditions after the tsunami were challenging – as people took years to move from temporary accommodation to permanent housing. This meant that many livelihoods had to first adjust to the chaotic temporary phase of the reconstruction and then re-adjust to the new post-tsunami reality. Even very generous and well planned out livelihood restoration programs can only have so much influence over outcomes following a disaster as devastating as the 2004 tsunami.

*Livelihood Development:* Livelihood development programs met with low rates of success, especially when factoring in the amounts of resources expended. It was difficult for people without pre-disaster livelihood experience to successfully start a new livelihood based upon aid programs. It was especially difficult for people lacking sufficient vocational and business management skills to set up and operate a micro-enterprise. However, we found that a significant number of livelihood participants without pre-tsunami experience, including many women, were able to use the training they received to find ad hoc, part-time work – usually in support of someone with pre-disaster experience. While more modest than the goals of most donors, this form of livelihood promotion is much more feasible and arguably better use of limited resources than encouraging people to start up micro-enterprises.

Technical support and small business training resulted in only minor changes in the conduct of pre-tsunami livelihoods. For agriculture and aquaculture, technical changes were often the result of more extended collaboration between beneficiaries, aid providers, and local government departments – allowing for a gradual long-term development of skill sets supported by monitoring. Investments in infrastructure, such as new roads, refurbished ports, markets, and processing facilities

supported livelihood development. We have seen evidence, especially within the fishing sector, of increasing employment opportunities and value chain enhancement brought about by such infrastructure improvements. Below we elaborate on the main factors that influenced the effectiveness and sustainability of the different categories of livelihood assistance.

## 5.1. Factors influencing aid outcomes

### 5.1.1. Overly inclusive beneficiary selection and aid targeting

Perhaps the most important determinant of the success and sustainability of livelihood programs was the selection of aid beneficiaries. It was widely reported by our respondents that projects were much more likely to be successful if they targeted the rehabilitation of pre-tsunami livelihoods through providing assets, financing and training to help replace what was lost during the tsunami. Targeting livelihood aid to people with pre-tsunami livelihood experience allowed donors to leverage pre-existing capacities, skillsets, business knowledge, work ethic, motivation, and market networks. This finding strongly supports aid targeted at livelihood restoration and concurs with other studies of post-disaster livelihood aid [25,27,37].

Many of our respondents mentioned that the motivation, dedication and work ethic of beneficiaries was a major factor separating those who succeeded from those who failed. The vast majority of our respondents told us that it didn't matter what aid was provided if beneficiaries were not willing to put in the hard work and make sacrifices to succeed. Many respondents were puzzled that NGOs provided aid to people who were not interested in livelihoods, or who clearly lacked the skills and/or experience in a particular livelihood.

### 5.1.2. Insufficient training in vocational and business management skills

Significant levels of vocational skills are required to successfully engage in livelihoods at a professional level. This level of skill, even for 'traditional' livelihoods such as fishing, farming, baking, etc., is often the product of a lifetime of experience. A respondent told us that many participants within a sewing livelihood program failed to start a business because "they were not experts in sewing ... maybe they were housewives or worked in other sectors. Unfortunately, only people who were already tailors were able to take advantage of the livelihood aid and run a business that is still successful today." This point came up repeatedly across all sectors. To be successful, beneficiaries needed sufficiently high skill sets within their profession to provide commercially viable services or products. It was difficult for beneficiaries who lacked a foundation of prior experience and skills to obtain 'professional grade' vocational skills that could sustain a business within relatively brief training programs. However, some beneficiaries without pre-tsunami livelihood experience were able to acquire sufficient vocational skills to find casual and part-time employment doing low-skilled work.

Many beneficiaries were not able to establish or maintain a sustainable micro-enterprise because they could not map out and stick to a business plan, manage their finances, market their products, and reinvest revenue into their enterprise over an extended period. This was a major obstacle for many beneficiaries – even those with prior livelihood experience. Many beneficiaries struggled to separate revenue from household income, which depleted capital needed for replenishing stock, offsetting asset depreciation, and buffering uncertainty. Respondents commonly cited the costs of supplies and other forms of overhead as reasons why their business failed, or were difficult to maintain. Many complained that they did not receive additional aid. Donor-provided business training programs that enrolled people with no previous livelihood experience typically were brief and only provided a superficial engagement with the subject. Overall we found that the

ambitions of such capacity enhancement programs greatly exceeded the practical realities of what they could accomplish.

### 5.1.3. Diversion of aid

The priority of many beneficiaries was understandably the day-to-day survival and comfort of their families. This led to a significant percentage of livelihood aid being diverted towards household needs such as communication, food, school fees, clothing, etc. We found many instances where people sold assets that they received from livelihood restoration and development programs. It was common for micro-credit programs and revolving funds to fail because people used the cash for non-livelihood uses. It was also common for people to start up a livelihood but to divert the revenue generated for household purposes.

### 5.1.4. Long-term damage and disorientation from the tsunami and reconstruction

The tsunami caused extensive physical damage and environmental degradation that limited livelihood restoration, especially for agriculture and aquaculture. The complete decimation of the built environment dramatically reduced the assets, networks and labor needed for livelihoods as well as a significant percentage of household wealth. Many beneficiaries, including people with pre-tsunami livelihood experience, reported that they were not able to focus and commit their time to building a livelihood during the first several years of the reconstruction, which was when most of the livelihood programs were rolled out.

### 5.1.5. Loss of Lives and Diversion of Labor

The tsunami killed large numbers of people and wiped out an accumulated body of skills, experience, connections and knowledge that were vital to economic functioning. The loss of life also greatly reduced the base of customers during the first several years after the tsunami. High mortality rates created complex inheritance scenarios and in some cases people who inherited land and/or businesses lived outside the village and, as was common in agriculture, had little interest in moving to the village and continuing the livelihoods of those who died.

This disorientation was exacerbated by the wide-range of livelihood opportunities suddenly made available, both in the form of livelihood assistance programs and cash-for-work (i.e. providing manual labor, working for NGOs as translators or drivers etc.). The widely inclusive selection process of many livelihood programs, which used incentives such as cash and food, led large numbers of people to participate in livelihood development programs. For many of these beneficiaries, participating in and receiving aid became a form of livelihood during the first three years after the tsunami. This diverted attention away from traditional livelihoods such as fishing, agriculture, and aquaculture.

### 5.1.6. Market capacity and alignment

The number of participants within livelihood programs, especially micro-enterprises, greatly exceeded the capacity of local markets to absorb. Livelihood development programs flooded markets with many people with similar skill-sets, business plans, and aid packages. This competition made it virtually impossible for all beneficiaries who received aid, and were motivated to run a business, to be successful, including people with success at running a business before the tsunami. A respondent summed up the general sentiment: "who will buy all of these cakes?"

It was common for livelihood programs to provide beneficiaries with collective support. However, it was rare to find a group intact five years after receiving aid. Most of the group members were not fully invested in or able to succeed within their initial group. People who successfully set up businesses were often critical of groups and resented being grouped with people who were not interested in setting up a business.

## 5.2. Model for efficient use of post-disaster livelihood assistance

We present a model for structuring livelihood stabilization,

restoration and development programs to increase effectiveness and efficiency informed by our analysis of post-tsunami livelihood aid in Aceh (Table 9). We suggest that livelihood assistance could be more productive and cost effective if 1) aid is more carefully targeted and livelihoods are prioritized based upon how essential they are and when the post-disaster situation is suitable for them to be successful and sustainable; 2) stabilization, restoration, and development aid should be sequenced to be mutually supportive; and 3) aid is provided with a realistic understanding of what is possible at different phases of a post-disaster reconstruction.

*Livelihood Stabilization:* Providing 'daily living grants' or cash stipends can give households flexibility to strategize how best to adapt to the dislocation and relocation common during the emergency phase. While some recipients invested this funding into their livelihoods, most used such funding to support day-to-day living costs. Therefore, donors should not expect that small cash stipends and payments from cash-for-work programs will be used by beneficiaries to restore or develop livelihoods. Livelihood stabilization programs should expand the list of what are considered 'basic necessities' to include domestic goods essential for running a household such as clothing, school supplies, kitchen equipment, etc., as we found many households diverted livelihood assets or capital to restore basic household assets. Cash-for-work programs injected liquidity into households and local markets, while mobilizing labor to clean rubble, clear fields, and rebuild vital communal infrastructure. Cash-for-work programs should be considered part of livelihood stabilization as well as restoration. It is essential that donors ensure there are alternative ways to access cash for people who are not able to participate within cash-for-work programs.

Typically, livelihood stabilization programs wind down after debris and rubble have been cleared and the emergency phase is over. The Aceh case suggests that it is important to synchronize continued livelihood stabilization with the duration of livelihood restoration and development projects to limit the need for beneficiaries to sell economic assets, stock, and capital *obtained through livelihood assistance programs*. Livelihood stabilization should be a supporting component of livelihood restoration programs until beneficiaries and their livelihoods/enterprises are economically sustainable and able to cover the costs of household needs. Cash-for-work programs should anticipate longer-term construction and physical labor needs during the reconstruction period and, when possible, be designed so that participants acquire skills and experiences to continue in the labor force after cash-for-work programs end (merging livelihood stabilization with livelihood development).

Donors need to monitor economically marginal households that are attempting to restore or set up a new enterprise to determine how long they should provide livelihood stabilization assistance. It may be necessary to provide extra financial and material support to new workers trained during livelihood development programs to ensure that they are able to stabilize the economic situation of their households. However, caution must be taken as there is a danger of 1) building up longer-term dependency on continued aid, and 2) creating social tensions between vulnerable households who are trying to establish an enterprise (and thus receiving continued support) and vulnerable households who are not trying to establish an enterprise (and thus do not receive continued support).

*Livelihood Restoration:* Needs assessments should determine which pre-disaster livelihoods are most essential to the functioning of temporary settlements and can reasonably be resumed in difficult and unstable post-disaster environments. Donors should prioritise immediate assistance in the form of capital (grants) and asset replacement/provision to quickly jumpstart targeted essential livelihoods. As the reconstruction progresses, livelihood programs can support an increasingly wide range of livelihoods beyond the more narrowly defined list of 'essential' livelihoods prioritized during the early reconstruction period. Livelihood restoration is best supported by identifying which losses caused by the disaster are the main impediments to restoring different pre-disaster

**Table 9**

Summary of livelihood assistance model based upon our research findings in post-tsunami Aceh. The shading indicates what was done during the Aceh reconstruction (not shaded) and what our model proposed for future cases (shaded grey).

	Emergency Phase	Peak Reconstruction (pre-housing)	Late Reconstruction (post-housing)
<b>Stabilization</b>	Provision of food and basic necessities Provision of basic essential domestic assets Provision of daily living grants Provision of cash-for-work programs	Continue as necessary for vulnerable households. Monitor daily needs of people participating in livelihood protection programs	Continued monitoring of most vulnerable households. Extra support specifically targeting new workers trained during livelihood promotion programs
<b>Restoration</b>	Immediate economic needs assessment to determine disaster impact upon livelihoods Identification of pre-disaster work force (non-civil servants). Drafting of plan to maximize livelihood restoration based upon losses and needs. Assess the logical timing of livelihood restoration based upon progress of the reconstruction Identify professional skills/crafts/experiences essential to emergency and reconstruction related tasks (start mobilizing labor necessary to facility short-term reconstruction needs).	Provision of assets, capital and stock to assist resumption of pre-disaster livelihoods. Support for construction of temporary economic infrastructure (shops-kiosks, warehouses, food places, etc.) Prioritizing restoration of vital permanent communal economic infrastructure (markets, water management features, roads, utilities, docks, etc.)	Continued monitoring of beneficiaries. Special attention paid to ensure that people who have restored/resumed their livelihoods have access to sufficient capital to cover short term capital needs so that they can front costs of operations to obtain larger economic benefits.
<b>Development</b>	Inclusive employment through cash-for-work for low skilled reconstruction tasks (clearing debris, child care, recycling building materials, preparation of food, provision of basic necessities.	Vocational and small business training to bolster people who are in the processes of restoring their pre-disaster livelihoods. Limited financial and asset provision to support people with pre-disaster livelihoods to transfer to a new livelihood/profession. Widely inclusive short term basic financial literacy training – with an emphasis upon managing domestic finances and cash acquired from cash-for-work or forms of temporary employment as part of the reconstruction process. Inclusive, long-term vocational (skills) training for people lacking pre-disaster livelihoods. This training should involve extensive ‘hands-on’ learning, possibly through an apprentice model.	Selective provision of assets and capital to support people to scale-up, professionalize, diversify, etc. their pre-disaster livelihood. Programs to incorporate people trained in vocations through livelihood promotion programs to work within established businesses. Formation of local labor pools of people who received vocational training that can be used for ad-hoc labor by established enterprises. Provision of assets, business spaces, and capital to new workers to support development of micro-enterprises. This should be done on a highly selective basis, focusing upon people who have excelled during vocational training programs and show high likelihood of being able to manage a business/enterprise on their own.

livelihoods. The closer aid comes to matching what was lost during the disaster, the more efficient and effective the outcome.

Cash-for-work was essential for resuming agriculture and aquaculture and most likely contributed to the resumption of other livelihoods. However, we found that cash-for-work programs tended to draw people away from re-starting their pre-tsunami livelihoods, which consequently slowed the restoration of parts of the local economy. It is crucial to design both cash-for-work and livelihood restoration programs in such a way that people are encouraged to re-start their previous livelihoods as soon as conditions are viable.

Many livelihoods require physical spaces, facilities, and infrastructure to function. However, donors provided only limited support to rebuild such facilities or provide temporary facilities after the tsunami, which limited the pace of livelihood restoration. Donors and governments should prioritise the construction/provision of temporary economic infrastructure such as shops, warehouses, food places, production centers, etc. This should be done both within temporary settlements and as early as possible at *in situ* reconstruction settlements, or the site of new permanent housing.

Donors should synchronize livelihood restoration initiatives with the construction of permanent housing and wider communal infrastructure. Given that many micro-enterprises were physically integrated into domestic spaces before the tsunami, livelihood restoration can be expedited by incorporating work space into the design and construction of permanent housing for some beneficiaries. The importance of different forms of infrastructure to the timely resumption of livelihoods should be an explicit consideration when planning, scheduling and implementing large scale physical infrastructure projects. Finally, aid providers need to be aware that a combination of short-term employment opportunities during the reconstruction process and the wide scale and inclusive availability of livelihood development programs can distract from parallel livelihood restoration programs.

It can often take years after a major disaster for people to achieve a

sustainable steady state where they can withstand economic stresses and unforeseen challenges. It is important for aid providers to continue careful monitoring of beneficiaries and to start transitioning these efforts to local government or NGOs. One of the main impediments for maximizing the economic benefits of livelihood restoration programs was the lack of access of short-term operational capital. Special micro-credit schemes specifically for this purpose, with stringent rules and monitoring, should be made available where needed. Supporting the restoration of livelihoods is a multi-year commitment.

**Livelihood Development:** We found that livelihood development was much less effective than livelihood stabilization or restoration. We therefore recommend caution when it comes to rolling out livelihood development programs, especially during the early phases of the reconstruction. Livelihood development aid during this period should be conceptualized as two distinct tracks. The first track should focus on livelihood development programs for people *with* pre-disaster livelihood experience. This assistance should provide vocational, business management, and/or technical support to help people enhance the economic productivity and resilience of their livelihoods. Additionally, there is scope to provide limited amounts of capital, assets, and training to support people with pre-disaster livelihood experience to transition into new forms of livelihood, especially if there are potential obstacles preventing someone from resuming their pre-disaster livelihood.

The second track is for people lacking pre-disaster livelihood experience. We recommend (if resources allow) widely inclusive, short-term financial literacy training while people are living in temporary accommodations irrespective of their livelihoods and goals. Such programs do not need to be associated with specific livelihoods, but rather should include a range of small business management and household finance management. Our research shows that such programs can make a positive impact upon both the effectiveness of livelihoods and lead to a more informed management of household finances, which often overlapped. Livelihood development programs can also provide vocational



skills training (but *without* extensive allocation of assets, consumables, and capital) that explicitly aim to instill a sufficient level of vocational skills so that participants can work for more established professionals, and/or carry out ad hoc and part time work. This is a far more realistic goal than supporting people to establish new micro-enterprises that they have to run by themselves. Such programs would combine significant vocational training with hands-on work and apprentice placements (ideally with beneficiaries with pre-disaster experience receiving livelihood restoration assistance). This could help people find work, reduce the pressures to manage a micro-enterprise, and reduce the need to have high quality professional vocational skills. This could serve as an evaluation period to find suitable candidates to participate in more rigorous livelihood development programs.

As the situation stabilizes and people begin to return to permanent housing, livelihood development assistance can expand to focus on three goals if there are sufficient resources available. Assistance could be provided to help people expand the scale and scope of their livelihoods, professionalize their operations, and to train and hire more employees. This would require a combination of access to capital, additional training, and administrative support to deal with the legal requirements of formalizing a business. The second goal is to provide support for people who were not able to restore their pre-tsunami livelihoods but are interested in working. Not all livelihoods can be restored, and so it is important to have dedicated support to help people transition to different forms of livelihood/employment.

The third goal is to provide a supportive environment for people who lacked pre-disaster livelihood experience and participated in post-disaster livelihood programs. We found large numbers of beneficiaries who lacked professional skill sets but were able to work in a limited capacity. Efforts should be made to help incorporate people in this category within established businesses. Continued assistance should be provided to a selected range of livelihood beneficiaries who excelled during vocational training and demonstrate a high likelihood of being able to manage a sustainable livelihood/micro-enterprise. This latter goal can potentially transition into a long-term development project, but we feel it is largely outside the scope, resources, capabilities, and time frame of a post-disaster reconstruction initiative to manage such longer-term commitments. Such initiatives are better left to government agencies and donors/NGOs with the experience, resources, commitment and mandate to engage in longer-term economic development initiatives.

## 6. Conclusion

The livelihood programs in Aceh, in conjunction with aid in other sectors, played a major role in helping the people of Aceh rebuild. Given the significant resources invested, this is encouraging, and suggests that livelihood aid had positive impacts. While our data does not allow for a detailed quantitative assessment of return on investment for specific projects, it does provide a useful 'big-picture' overview that contributes to discussions about conceptualizing and implementing livelihood support in post-disaster situations.

One of the main 'lessons learned' is that modest ambitions are most likely to result in more efficient and effective uses of aid and that these ambitions need to be firmly grounded in the both the pre-disaster economic situation and in post-disaster realities. The tsunami response received an unusually high level of funding, and therefore agencies had the relative luxury of rolling out widely inclusive projects and spending on livelihood programs that aligned with international humanitarian mandates to 'build-back-better' to reduce economic vulnerabilities. However, in a situation with less funding, difficult trade-offs need to be made between investing livelihood aid in ways that will most likely provide higher success rates (livelihood stabilization and restoration), and investing in livelihood development, which arguably is less likely to succeed.

This raises several questions about the potential of post-disaster

livelihood assistance: Were the limitations we identified in Aceh to restore and develop livelihoods the result of recipients and participants not being in a position during the reconstruction period to fully benefit from what was offered? Or were they the result of the types of aid and levels of capacity building not being designed in a way that could allow for longer-term development? We feel the limitations derive from both the difficult position of aid recipients and the conceptual suitability of aid programs. This leads to another important question: Could different aid packages have led to more promising development outcomes? As outlined in our model above, we feel there are ways for post-disaster livelihood assistance to support better and more efficient outcomes. However, we also feel that the pressures and constraints faced by both disaster-affected persons and aid organizations within the chaotic, emotionally intense, and all-to-brief formal reconstruction periods are inherently incompatible with the kinds of interventions that are needed to support higher levels of economic development. It could take years for a post-disaster situation to stabilize enough so that people could better leverage aid, and sustainable development initiatives require intensive commitments from aid agencies that extend far beyond the narrow 'reconstruction' window.

The Aceh case makes it clear that there are inherent inconsistencies between the mechanisms through which large-scale aid efforts are implemented and the types of support that would work best for household livelihoods. The optimal way to support both livelihood restoration and development would be to have unique interventions that are customized at the household level, based upon a comprehensive analysis of local markets, available resources and funding, and beneficiary capacities. This is logistically and financially difficult to carry out in practice. We suggest that designing livelihood aid programs in a more structured manner (as outlined above) could help to shape livelihood interventions to better fit distinct categories of beneficiaries based upon livelihood type, level of skills, and experience. However, this requires prioritizing different groups of beneficiaries based upon variables such as type of livelihood, the schedule and progress of reconstruction, and levels of pre-disaster skills and experience.

How to set priorities touches upon a final set of conceptual challenges regarding livelihood aid in post-disaster situations. Livelihood programs in post-tsunami Aceh show that donors and aid providers are trapped in a somewhat awkward position between two different and potentially mutually exclusive goals. The humanitarian impulse is to provide support widely and especially to engage in livelihood development to help address underlying social and economic vulnerabilities. This is coupled with apprehension that aid should not reinforce pre-disaster economic and political hierarchies. This humanitarian logic supports wide-spread and non-discriminatory livelihood development programs carried out in parallel with livelihood stabilization and restoration programs. However, this might potentially clash with more pragmatic institutional goals of efficiently investing aid resources to maximise economic impact.

Our data suggests that if the broader goal is revitalizing economies damaged by a disaster, then it is more effective to invest resources in people who are most likely to productively utilize them and potentially better positioned to restore markets and generate employment. However, this is likely to replicate pre-disaster economic inequality. A trade-off between inefficiency and inequality is unappealing, but our study suggests it exists. Carefully identifying the diverse goals driving livelihood aid and the strategies to achieve those goals can help aid providers and affected communities find an appropriate balance that effectively re-starts the local economy while also providing opportunities to improve their livelihoods.

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## Acknowledgement

The results in this paper are part of the Aftermath of Aid project, a collaboration between the Earth Observatory of Singapore, the International Centre for Aceh and Indian Ocean Studies, and Syiah Kuala University. We would like to thank all of the AoA project staff who assisted us with data collection. This research is supported by the National Research Foundation Singapore, and the Singapore Ministry of Education under the Research Centres of Excellence initiative. This work comprises Earth Observatory of Singapore contribution no. 297.

## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ijdr.2020.101650>.

## References

- [1] S. Prasad, H.C. Su, N. Altay, J. Tata, Building disaster-resilient micro enterprises in the developing world, *Disasters* 39 (2015) 447–466.
- [2] K. Tierney, Business impacts of the Northridge earthquake, *J. Contingencies Crisis Manag.* 5 (1997) 87–97.
- [3] M. Khan, M. Sayem, Understanding recovery of small enterprises from natural disaster, *Environ. Hazards* 12 (2013) 218–239.
- [4] D. Alesch, C. Taylor, S. Ghanty, Earthquake risk reduction and small business, in: K. Tierney, J. Nigg (Eds.), *National Earthquake Conference Monograph 5: Socioeconomic Impacts*. Memphis: Central United States Earthquake Consortium, Central United States Earthquake Consortium, Memphis, 1993, 1993.
- [5] J. Handmer, W. Choong, Disaster resilience through local economic activity in Phuket, Aust. *J. Emerg. Manag.* 21 (2006) 8–15.
- [6] A. Neef, A. Panyakotkaew, P. Elstner, Post-tsunami recovery and rehabilitation of small enterprises in phang nga province, southern Thailand, in: R. Shaw (Ed.), *Recovery from the Indian Ocean Tsunami: A Ten-Year Journey*, Springer, New York, 2016.
- [7] D. Venn, Helping displaced workers back into jobs after a natural disaster: recent experiences in OECD Countries. OECD Social, Employment and Migration Working Papers, 2012.
- [8] B. Alexander, C. Chan-Halbrendt, W. Salim, Sustainable livelihood considerations for disaster risk management, *Disaster Prev. Manag.* 15 (2006) 31–50.
- [9] P. Regnier, From Post-tsunami Emergency Assistance to Livelihood Recovery in South India: Exploring the Contribution of Micro-entrepreneurship Initiatives in the Gulf of Mannar, Tamil Nadu. *Terre des Hommes Suisse*, 2007.
- [10] D. Sina, A. Chang-Richards, S. Wilkinson, R. Potangaroa, What does the future hold for relocated communities post-disaster? Factors affecting livelihood resilience, *International Journal of Disaster Risk Reduction* 34 (2018) 173–183.
- [11] J. Wu, N. Li, W. Xie, Y. Zhou, Z. Ji, P. Shi, Post-disaster recovery and economic impact of catastrophes in China, *Earthq. Spectra* 30 (2014) 1825–1846.
- [12] Y. Wang, Z. Zou, J. Li, Influencing factors of households disadvantaged in post-earthquake life recovery: a case study of the Wenchuan earthquake in China, *Nat. Hazards* 75 (2015) 1853–1869.
- [13] T. Vu, I. Noy, Regional effects of natural disasters in China: investing in post-disaster recovery, *Nat. Hazards* 75 (2015) 111–126.
- [14] W. Ting, Asset building and livelihood rebuilding in post-disaster Sichuan, China, *China J. Soc. Work* 6 (2013) 190–207.
- [15] A. Jha, J. Dwayne Barenstein, P. Phelps, D. Pittet, S. Sena, *Safer Homes, Stronger Communities: A Handbook for Reconstructing after Natural Disasters*, The World Bank, Washington DC, 2010.
- [16] Unisdr, *Hyogo Framework for Action 2005 - 2015: Building the Resilience of Nations and Communities to Disasters*, United Nations, Geneva, 2005.
- [17] Unisdr, *Sendai Framework for Disaster Risk Reduction 2015 - 2030*, United Nations, Geneva, 2015.
- [18] M. Anderson, A reconceptualization of the linkages between disasters and development, *Disasters* 9 (1985) 49–51.
- [19] D. Archer, S. Boonyabancha, Seeing a disaster as an opportunity – harnessing the energy of disaster survivors for change, *Environ. Urbanization* 23 (2011) 351–364.
- [20] P. Berke, J. Kartez, D. Wenger, Recovery after disaster: achieving sustainable development, mitigation and equity, *Disasters* 17 (1993) 93–109.
- [21] M. Buchanan-Smith, S. Maxwell, Linking relief and development: an introduction and overview, *IDS Bull.* 25 (1994) 2–16.
- [22] N. Kapucu, K. Liou, Disasters and development: investigating an integrated framework, in: N. Kapucu, K. Liou (Eds.), *Disaster and Development*, Springer, Zurich, 2014.
- [23] S. Mannakkara, S. Wilkinson, Re-conceptualizing “Build Back Better” to improve post-disaster recovery, *Int. J. Manag. Proj. Bus.* 7 (2014) 327–341.
- [24] B. Wisner, P. Blaikie, T. Cannon, I. Davis, *At Risk: Natural Hazards, People’s Vulnerability and Disasters*, Routledge, London, 1994.
- [25] P. Daly, R.M. Feener, M. Jauhola, C. Thorburn, Blueprints for change in post-tsunami Aceh, Indonesia, in: P. Daly, R.M. Feener (Eds.), *Rebuilding Asia Following Natural Disasters: Approaches to Reconstruction in the Asia-Pacific Region*, Cambridge University Press, Cambridge, 2016.
- [26] P. Dorosh, S. Malik, M. Krausova, Rehabilitating agriculture and promoting food security after the 2010 Pakistan floods: insights from the South Asian experience, *Pakistan Dev. Rev.* 49 (2010) 167–192.
- [27] E. Joakim, S. Wismer, Livelihood recovery after disaster, *Dev. Pract.* 25 (2015) 401–418.
- [28] K. Kapadia, Sri Lankan livelihoods after the tsunami: searching for entrepreneurs, unveiling relations of power, *Disasters* 39 (2014) 23–50.
- [29] K. Khan, N. Shanmugaratnam, I. Nyborg, Recovering from disasters: a study of livelihoods in post-quake villages in northern Pakistan, *Disasters* 39 (2015) 339–361.
- [30] P. Athukorala, B. Resosudarmo, The Indian Ocean Tsunami: economic impact, disaster management, and lessons, *Asian Econ. Pap.* 4 (2005) 1–39.
- [31] BRR, *Case Study: the Scattered Beads. Banda Aceh: the Executing Agency of Rehabilitation and Reconstruction for Aceh and Nias*, 2009.
- [32] J. Cosgrave, A Ripple in Development? Document Review: Annotated Bibliography Prepared for the Joint Follow-Up Evaluation of the Links between Relief, Rehabilitation and Development (LRRD) in Responses to the Indian Ocean Tsunami. Stockholm, 2009.
- [33] N. Ismail, K. Okazaki, C. Ochiai, G. Fernandez, Livelihood changes in Banda Aceh, Indonesia after the 2004 Indian Ocean tsunami, *International Journal of Disaster Risk Reduction* 28 (2018) 439–449.
- [34] D. Sanderson, Cities, disasters and livelihoods, *Environ. Urbanization* 12 (2000) 93–102.
- [35] L. Garces, M. Pido, R. Pomeroy, S. Koeshendrajana, B. Prisantoso, N. Fatan, D. Adhuri, T. Raiful, S. Rizal, A. Tewfik, M. Dey, Rapid assessment of community needs and fisheries status in tsunami-affected communities in Aceh Province, Indonesia, *Ocean Coast Manag.* 53 (2010) 69–79.
- [36] Bappenas, *Master Plan for Rehabilitation and Reconstruction for the Regions and People of the Province of Nanggroe Aceh Darussalam and Nias Islands of the Province of North Sumatra*, BAPPENAS, Jakarta, 2005.
- [37] C. Thorburn, Livelihood recovery in the wake of the tsunami in Aceh, *Appl. Artif. Intell.* 45 (2009) 85–105.
- [38] J. McCarthy, Using community led development approaches to address vulnerability after disaster: caught in a sad romance, *Global Environ. Change* 27 (2014) 144–155.
- [39] M. Mulligan, I. Ahmed, J. Shaw, D. Mercer, Y. Nadarajah, Lessons for long-term social recovery following the 2004 tsunami: community, livelihoods, tourism and housing, *Environ. Hazards* 11 (2012) 38–51.
- [40] P. Regnier, B. Neri, S. Scuteri, S. Miniati, From emergency relief to livelihood recovery: lessons learned from post-tsunami experiences in Indonesia and India, *Disaster Prev. Manag.* 17 (2008) 410–429.
- [41] J. Handmer, M. Hillman, Economic and financial recovery from disaster, *Aust. J. Emerg. Manag.* 19 (2004) 44–50.
- [42] D. de Silva, M. Yamao, Effects of the tsunami on fisheries and coastal livelihood: a case study of tsunami-ravaged southern Sri Lanka, *Disasters* 31 (2007) 386–404.
- [43] R. Dixon, A. Mcgregor, Grassroots development and upwards accountabilities: tensions in the reconstruction of Aceh’s fishing industry, *Dev. Change* 42 (2011) 1349–1377.
- [44] H. Janssen, Study on the post-tsunami rehabilitation of fishing communities and fisheries-based livelihoods in Indonesia, Banda Aceh (2005).
- [45] P. Daly, Embedded wisdom or rooted problems? Aid workers’ perspectives on local social and political infrastructure in post-tsunami Aceh, *Disasters* 39 (2014) 232–257.
- [46] P. Daly, Y. Rahmayati, Cultural heritage and community recovery in post-tsunami Aceh, in: P. Daly, R.M. Feener, A. Reid (Eds.), *From the Ground up: Perspectives on Post-Tsunami and Post-Conflict Aceh*, ISEAS Press, Singapore, 2012.
- [47] K. Ruwanpura, Temporality of disasters: the politics of women’s livelihoods ‘after’ the 2004 tsunami in Sri Lanka, *Singapore J. Trop. Geogr.* 29 (2008) 325–340.
- [48] Undp, *Livelihoods & Economic Recovery in Crisis Situations*, United Nations Development Programme, New York, 2013.
- [49] IFRC, *IFRC Guidelines for Livelihoods Programming*, International Federation of Red Cross and Red Crescent Societies, Geneva, 2010.
- [50] FAO, *FAO Impacts of the Tsunami on Fisheries, Aquaculture, and Coastal Livelihoods in Indonesia*, Food and Agriculture Organization of the United Nations, Indonesia, 2005.
- [51] R. Pomeroy, B. Ratner, S. Hall, J. Pimoljinda, V. Vivekanandan, Coping with disaster: rehabilitating coastal livelihoods and communities, *Mar. Pol.* 30 (2006) 786–793.
- [52] A. Tewfik, L. Andrew, C. Bene, L. Garces, Reconciling poverty alleviation with reduction in fisheries capacity: boat aid in post-tsunami Aceh, Indonesia, *Fish. Manag. Ecol.* 15 (2008) 147–158.
- [53] C. Wilson, M. Linke, The Panglima Laot of Aceh: a case study in large-scale community-based marine management after the 2004 Indian Ocean tsunami, *Oryx* 46 (2012) 495–500.
- [54] P. Daly, A. Halim, Ardiansyah Nizamuddin, D. HUNDLani, E. Ho, S. Mahdi, Rehabilitating coastal agriculture and aquaculture after inundation events: spatial analysis of livelihood recovery in post-tsunami Aceh, Indonesia, *Ocean Coast Manag.* 142 (2017) 218–232.
- [55] C. Griffin, D. Ellis, S. Beavis, D. Zoleta-Nantes, Coastal resources, livelihoods and the 2004 Indian Ocean tsunami in Aceh, Indonesia, *Ocean Coast Manag.* 71 (2013) 176–186.
- [56] C. Marohn, A. Distel, G. Dercon, Tomlinson R. Wahyunto, M. Noordwijk, G. Cadisch, Impacts of soil and groundwater salinization on tree crop performance in post-tsunami Aceh Barat, Indonesia, *Nat. Hazards* 12 (2012) 2879–2891.
- [57] P. Athukorala, Indian Ocean tsunami: disaster, generosity and recovery, *Asian Econ. J.* 26 (2012) 211–231.

- [58] I. Christoplos, Links between relief, rehabilitation and development in the tsunami response, Tsunami Evaluation Coalition, 2006.
- [59] P. Daly, R.M. Feener, A. Reid (Eds.), *From the Ground up: Perspectives on Post-conflict and Post-Tsunami Aceh*, ISEAS Press, Singapore, 2012.
- [60] G. Fink, S. Redaelli, Determinants of international emergency aid - humanitarian need only? *World Dev.* 39 (2011) 741–757.
- [61] E. Brusset, M. Bhatt, K. Bjornestad, J. Cosgrave, A. Davies, Y. Deshmukh, J. Haleem, S. Hidalgo, Y. Immajati, R. Jayasundere, A. Mattsson, N. Muhaimin, R. Polastro, T. Wu, A Ripple in Development? Long Term Perspectives on the Response to the Indian Ocean Tsunami 2004, SIDA, Stockholm, 2009.
- [62] J. McCaughey, P. Daly, I. Mindzir, S. Mahdi, A. Patt, Socio-economic consequences of post-disaster reconstruction in hazard-exposed areas, *Nature Sustainability* 1 (2018) 38–43.
- [63] T. Hayashi, Japan's post-disaster economic reconstruction: from Kobe to Tohoku, *Asian Econ. J.* 26 (2012) 189–210.
- [64] S. Hallegatte, P. Dumas, Can natural disasters have positive consequences? Investigating the role of embodied technical change, *Ecol. Econ.* 68 (2009) 777–786.
- [65] C. Galbraith, C. Stiles, Disasters and entrepreneurship: a short review, *Developmental Entrepreneurship: Adversity, Risk and Isolation* 5 (2006) 147–166.
- [66] P. Freeman, L. Martin, R. Mechler, K. Warner, A methodology for incorporating natural catastrophes into macroeconomic projections, *Disaster Prev. Manag.* 13 (2004) 337–342.
- [67] C. Benson, E. Clay, Understanding the economic and financial impacts of natural disasters, in: A. Baker (Ed.), *Disaster Risk Management Series*, World Bank, Washington, DC, 2004.
- [68] A. Chhiber, R. Laajaj, Disasters, climate change and economic development in Sub-Saharan Africa: lessons and directions, *J. Afr. Econ.* 17 (2008) 7–49.
- [69] D. Dacy, H. Kunreuther, *The Economics of Natural Disasters: Implications for Federal Policy*, Free Press, New York, 1969.
- [71] S. Hallegatte, V. Przyluski, *The Economics of Natural Disasters: Concepts and Methods*, World Bank Policy Research Working Paper, 2010.
- [72] M. Skidmore, H. Toya, Do natural disasters promote long-run growth? *Econ. Inq.* 40 (2007) 664–687.
- [73] d. Alesch, I. arendt, J. holly, *Managing for Long-Term Community Recovery in the Aftermath of Disaster*, Public Entity Risk Institute, Fairfax VA, 2009.
- [74] S. Chang, A. Rose, Towards a theory of economic recovery from disasters, *Int. J. Mass Emergencies Disasters* 32 (2012) 171–181.
- [75] M. Landahl, T. Neaves, Small businesses as a vulnerable population, in: A. LEPORE (Ed.), *The Future of Disaster Management in the U.S.: Rethinking Legislation, Policy, and Finance*, Routledge, New York, 2017.
- [76] P. Raschky, Institutions and the losses from natural disasters, *Nat. Hazards Earth Syst. Sci.* 8 (2008) 627–634.