HOUSEHOLD AND BUILDING DAMAGE ASSESSMENT

OF FLOODS IN TIMOR-LESTE

APRIL 2021

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INTRODUCTION

Crisis Context

Tropical Cyclone Seroja was followed by heavy rains across Timor-Leste from 29 March 2021 to 4 April 2021, resulting in flash floods and landslides affecting all 13 municipalities in Timor-Leste to varying degrees, with the capital Dili and the surrounding low-lying areas the worst-affected. A total of 48 fatalities (including 14 missing and presumed dead) have been recorded[1]. On 8 April 2021, the Government declared a state of calamity in Dili for a period of 30 days and requested for international assistance. According to official figures, a total of 30,564 households have been affected across all 13 municipalities with over 81% of the affected households in Dili municipality[2]. Flash floods caused landslides, damage to houses, buildings and public infrastructure including sections of highways and city roads.

The cyclone and floods occurred as the country faced a surge in COVID-19 cases, with the municipality of Dili under a strict lockdown since 9 March 2021. An inter-agency Socio-economic Impact Assessment (SEIA) is currently ongoing to assess the impacts of COVID-19 within the country. In addition to the pandemic, the cumulative effects of Tropical Cyclone Seroja and the Easter floods are expected to have severe impacts on the socio-economic conditions of the population, particularly in municipalities such as Ainaro (0.545) and Baucau (0.584) which are already low on the Human Development indicators, as compared to the national average.

Humanitarian Response

The Government of Timor-Leste, through the Secretary of State for Civil Protection together with other ministries, is currently leading the humanitarian response operations. The authorities quickly ramped up search, rescue and evacuation operations and provided shelter, food and emergency supplies to the flood-affected people. They also immediately began clearing debris and restoring infrastructure to re-establish road mobility, electricity, water and sanitation supply systems. The Government made an initial allocation of USD 1.5 million from the 2021 State Budget for the flood response to cover the Government response for a period of three months (April to June 2021). On 23 April 2021, the National Parliament approved the amendment to the 2021 General State Budget to respond to the impacts of COVID-19 and Easter floods, which was subsequently promulgated by the President on 4 May 2021. The allocation to the COVID-19 Fund increased from USD 31 million to USD 287.6 million, while the Contingency Fund allocation increased from USD 23.8 million to USD 65.2 million[3].

In support of Government efforts, the humanitarian partners jointly responded to address the needs of disaster-affected people, in particular vulnerable groups including women, children, the elderly and people with disabilities. As a part of the 2020-2021 joint UN-NGOs La Niña preparedness planning, UN agencies had pre-positioned relief supplies in the UN Compound, which enabled rapid response. With the support of donors, humanitarian partners repurposed their existing resources and mobilized additional resources through corporate emergency response funds to kick-start multi-sectoral relief, primarily in Dili, to augment Government response.

UNDP Response

UNDP initiated its emergency response at the onset of the flooding on Sunday 4 April 2021. Initially, this centered on the provision of hot nutritious meals for flood-affected individuals temporarily displaced to evacuation shelters across the municipality of Dili.

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[1] *Situation Disaster Report Update for period 4 April – 10 August 2021 from National Disaster Operation Center (NDOC), Secretary of State for Civil Protection*

[2] *Situation Disaster Report Update for period 4 April – 10 August 2021 from National Disaster Operation Center (NDOC), Secretary of State for Civil Protection*

[3] *Joint Appeal & Flood Response Plan. Towards Recovery Timor-Leste. May 2021.*

As the impact of the flooding and landslides became more evident in the subsequent weeks, UNDP broadened its response to include the provision of drinking water, solar-powered lamps, assistance kits, and other food items. In total, between the 4th of April and 11th of May 2021, UNDP provided 11,630 nutritious hot meals (consisting of vegetables, rice, and protein), 141,300 liters of water (including installation of water tanks, provision of water with hot meals, and jerry cans), 34 assistance kits (including cleaning products, food items, and non-food items), 16 solar-powered lamps, 1,340 kg of dry foods (rice and beans), and 40 cartons of milk.

It is estimated that UNDP's response reached a conservative 12,694 flood-affected individuals across 22 shelters, organizations, and communities across Timor-Leste. Whilst UNDP's response focused on Dili Municipality, it also included smaller scale distributions of food and non-food items in Baucau Municipality and Oecusse Municipality. In addition to the provision of items to cover emergency needs, UNDP assisted the Government and Development/Humanitarian Partners in conducting assessments to better gauge the impact of the flood. This included the Multi-Sector Needs Assessment and Shelter Assessment led by the Secretary of State for Civil Protection and the International Organization for Migration, and a preliminary assessment of the impact of the flood on agriculture, specifically on fields using the Jajar Legowo System (JLS) in Oecusse Municipality led by the Regional Secretary of Education and Social Solidarity (SRESS-RAEOA).

The Secretary of State for Civil Protection and the Ministry of State Administration - supported by humanitarian partners – conducted a multi-sector rapid needs assessment immediately following the disaster.

The Humanitarian Partners Group – composed of UN agencies, international and national NGOs, Red Cross and Red Crescent Movement and donor representatives – also supported respective line ministries with sector-specific assessments such as Health, Nutrition, and Education in the first week of disaster onset. However, targeted response to the affected households were compromised by lack of availability of data particularly on the number of houses damaged and livelihoods affected.

In response to the information gaps and following request from the Government of Timor-Leste, the UNDP Country Office in Timor –Leste, with support from UNDP SURGE Data Hub, conducted a Household and Building Damage Assessment (HBDA), in collaboration with the Ministry of State Administration (MSA), Universidade Nacional Timor Lorosa'e (UNTL) and General Directorate of Statistics (GDS). The UNDP Crisis Bureau, with support from IMPACT initiatives, developed the HBDA methodology and toolkit, to support authorities in crisis-affected countries around the world, and assess residential and non-residential infrastructure in collecting timely data to inform decisions. In doing so, the toolkit facilitates the rapid collection of digital and georeferenced data, which includes household vulnerabilities, utility services, and materials needed for repairs. The HBDA is a comprehensive and multiphase process that involves mobile data collection through enumerators, followed by data analysis, visualization and dissemination for use by national and local authorities, and humanitarian and development partners. The library of questions within the HBDA is designed to be adaptable to different contexts.

ASSESSMENT OBJECTIVES

The objectives of Timor-Leste's HBDA were two-fold. First, to assess damage caused to buildings, and to assess the livelihoods conditions and needs of flood-affected households. Second, building on the assessment's results, to identify priority areas to consider for the post- Easter floods recovery strategy. Such an assessment is critical input for the detailed Post Disaster Needs Assessment (PDNA) being planned by the Government. With these considerations, the overarching objectives of Timor-Leste's HBDA endeavored to assess damage caused to buildings, in addition to the livelihood needs and conditions of flood-affected households. As per both the infrastructural and socioeconomic considerations of the HBDA's framework, the following four research questions were developed and categorized to guide the assessment's scope:

Building damage information:

- What is the extent of damage to residential and commercial buildings?
- What is the extent of damage to different components of buildings?

Household information:

- What are the conditions and needs of flood-affected households in terms of livelihoods?
- What are the views of the affected population for recovery following the flood?

ASSESSMENT METHODOLOGY

Methodology Overview

In responding to the research questions, and in line with the scope of the HBDA toolkit, primary data collection was the preferred method for collecting both quantitative and qualitative data, given its efficacy for gathering information specific to the objectives at hand, and ability to use procedures that best respond to information gaps. Moreover, specific attention was afforded to key information gaps, to inform evidence-based policymaking and recovery programming, including the upcoming Post-Disaster Needs Assessment (PDNA) process, or to improve the effectiveness of existing programmes.

Namely, building damage information was collected through field observations conducted by civil engineering experts from the UNTL, in conjunction with surveys with heads of households who resided in, or claimed ownership of, the damaged building in question. The latter method was also employed for gathering household information, with surveys conducted by enumerators from the GDS.

Scope and sampling Strategy

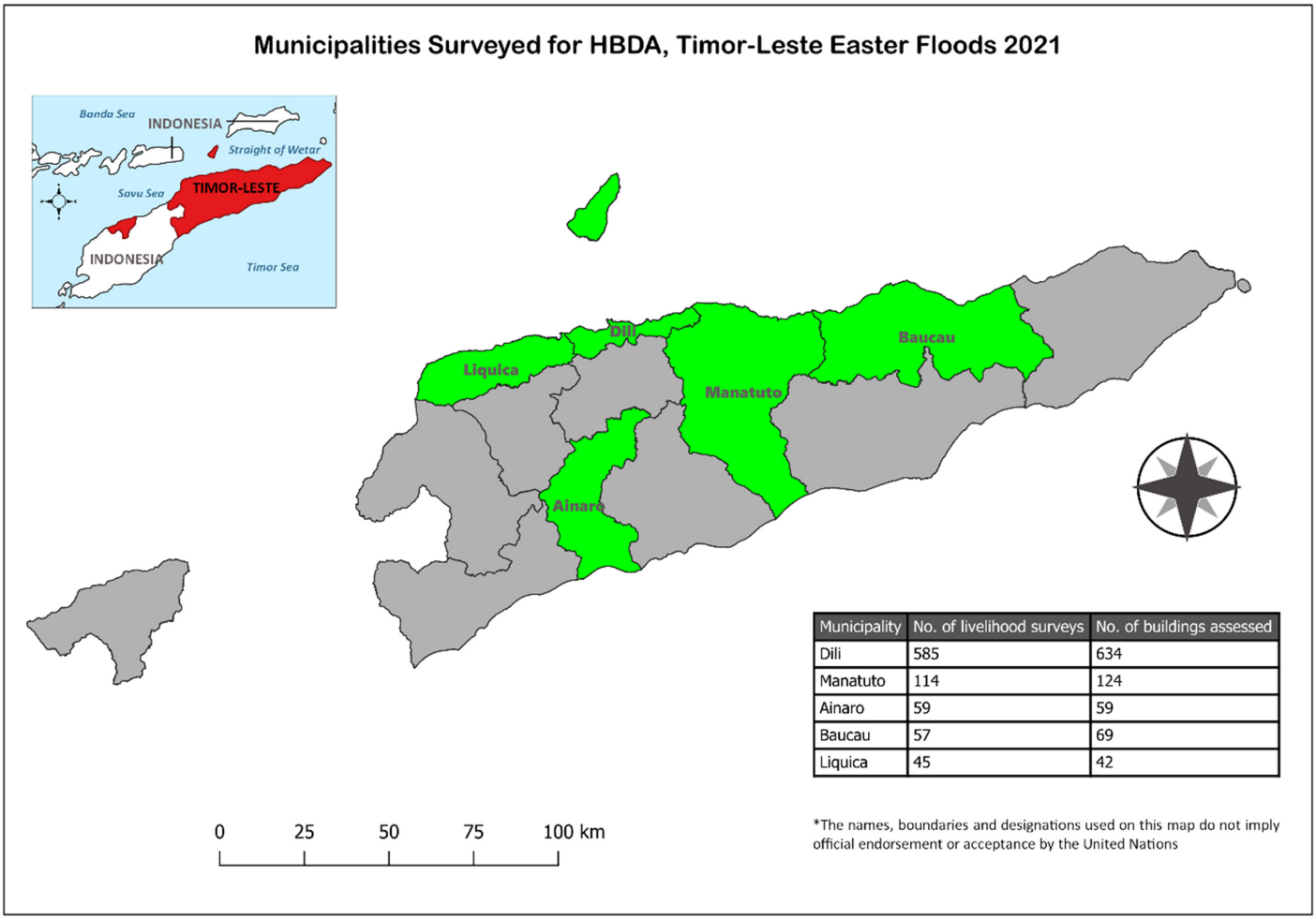
The geographical scope and populations of interest concerned buildings and households within the five worst impacted municipalities in Timor-Leste; namely, the municipality of Dili, which includes the capital city of the same name, in addition to Liquica, Manatuto, Buacau and Ainaro. Due to the varied nature of available baseline and secondary data, as well as limited resources and information needs on the populations of interest, a mixed-method approach was used for the sampling strategy.

Within Dili municipality, a two-phased approach was used to determine the sampling framework; namely, a purposive approach was succeeded by random sampling. To begin with, the most affected areas in Dili municipality were identified using data from satellite-derived imagery from UNITAR's Operational Satellite Applications Programme (UNOSAT), which pinpointed potentially affected structures. A random sample was then generated for each of these areas to identify individual buildings to be assessed, using the GPS coordinates from UNOSAT's data. The size of the sample was calculated by applying a 95% level of confidence and 5% margin of error, using the number of structures identified by UNOSAT in each "affected area."

For the four municipalities outside of Dili (i.e., Liquica, Manatuto, Baucau and Ainaro), only a purposive sampling method was employed. Potentially affected areas were identified using data on the estimated number of affected buildings and households based on the multi-sector rapid assessment by the Secretary of State for Civil Protection. Field teams travelled to the identified areas and then selected households for assessments in close cooperation with the local authorities, including municipal authorities, village and sub-village chiefs and municipality statistics office staff. As opposed to the municipality of Dili, sample units (buildings/households to survey) were therefore identified while in the field rather than prior. In contrast to data collected from within Dili, that collected in the surrounding four municipalities was only indicative of the general experiences of the population.

The questionnaire design employed in the HBDA exercise was tailored to allow more surveys to be conducted each day by reducing the time spent on each household. This was achieved by splitting the questionnaire into two surveys: one focusing on livelihoods and related socio-economic indicators, and the second focusing on the technical building damage assessment.

Figure 1: Data Collection (table of HH surveyed in each municipality – household sample and buildings



Municipality	No. of livelihood surveys	No. of buildings assessed
Dili	585	634
Manatuto	114	124
Ainaro	59	59
Baucau	57	69
Liquica	45	42

Data was collected using Kobo Toolbox over a period of two weeks between 2 June 2021 and 18 June 2021. Throughout, 20 enumerators worked together in pairs comprised of one General Directorate of Statistics (GDS) representative, responsible for collecting livelihoods data from respondents, and one representative from the UNTL's Faculty of Engineering, Science and Technology (FoEST), who simultaneously assessed building damage.

Data collection was preceded by a 'Training of the trainers' session in English to equip team leaders on the background to, and objectives of, the survey; the principles and practical aspects of humanitarian data collection; survey protocols; ethical considerations and standards; and the use of Kobo Toolbox for data collection. The team leaders in turn facilitated the 'Enumerator training,' in the local language (Tetum). Following the enumerator training, a 3-day pilot survey was conducted to identify outstanding technical errors on the digital data collection platform and provide the opportunity for enumerators to be familiar with each of the survey's questions, thereby mitigating the room for err in interpretation.

Data Processing and Analysis

Periodic data quality checks were conducted from the Kobo Toolbox Database, which was then recorded in a data-cleaning-log, whereby team leaders on the ground could identify issues that needed to be flagged or emphasized with the enumerators during daily briefing sessions. This improved the quality of data that was collected.

A preliminary analysis of the data was conducted to obtain findings on key indicators of the HBDA.

These preliminary findings were reported within a dashboard[4], providing an overview of the needs and conditions of flood-affected buildings and populations, of all municipalities combined.

More in-depth analyses focused on the livelihood and the building damage components of the assessment followed the preliminary analysis, to provide more specific insight into the needs and conditions of populations affected by the floods.

Limitations

Limitations should be kept in mind when engaging with the findings outlined in this HBDA report:

- The sampling strategy that was applied to the Municipality of Dili facilitated findings that were representative at the "area" level. As a result, aggregated findings for Dili municipality should be considered indicative only.
- The sampling strategy that was applied to the four municipalities outside of Dili did not generate representative findings. These should therefore be considered indicative only for their respective municipalities.
- Sampling frames were based on data available at the time of the assessment design. Affected areas that were not included in the sources used to develop the sampling frame may therefore not have been included in the HBDA, particularly outside of Dili.
- Some hard to reach areas may have been excluded as well, particularly outside of Dili, due to inaccessibility.

[4] https://bit.ly/3iGC0QU

Figure 2: How does bias result into data only serving an indicative purpose?

How does bias result into data only serving an indicative purpose?

All primary data collection activities employing the use of face-to-face surveys to respond inaccurately or falsely to questions, leading to a nonrandom deviation of the answers from their true value. On the other hand, the risks of probing or influencing respondents' answers by enumerators may have also resulted in biased or untrue data. It must be acknowledged that for the Timor-Leste HBDA, both the 'Training of the trainers' and 'Enumerator' training discussed the aforementioned risks and correct survey protocol. However, it remains difficult to mitigate these risks entirely, which is why, whenever possible, representative samples with a certain level of confidence and margin of error are generated. Random samples allow (among other factors) to factor in possible errors caused by bias and determine the extent to which they may have influenced the data.

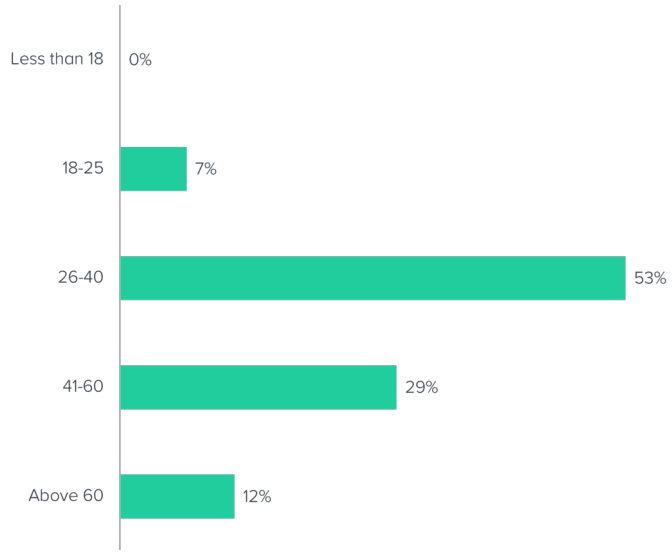
KEY FINDINGS – LIVELIHOODS

Respondent and Head of the Household Profile

The HBDA team assessed 928 buildings and conducted livelihoods surveys with 860 households, including 20 commercial businesses set up during the period from 2 to 18 June 2021. 90% of households are purely residential, while 8% are mixed (both residential and commercial) and 2% were purely commercial buildings. The survey respondents were comprised of 48% females and 52% males. However, 79% of the households were headed by men and 20% headed by women.

Among the head of the households, 53% were of the age group between 26 to 40 years (Figure 3). 14% of the head of the households reported some form of disability[5].

Figure 3: Age of Head of Household



Livelihoods and Income

According to the HBDA, Agriculture (28%), government service (15%) followed by artisan, fishery, small business, and service industry are the main sources of household income (figure 4). The most dominant sector of employment in Dili was reported as government service (17%). All other municipalities surveyed- Baucau (74%), Ainaro (64%), Manatuto (54%) and Liquica (27%) reported agriculture as their main sector of main income. A similar trend is reported in the latest Census (2015) where the agriculture sector provides direct employment for 64% of the workforce, followed by

[5] *Data on disabilities was collected using the Washington Group's short set of questions.*

Government that provides employment for 14% of workers making these the most dominant sectors of employment.

90% of the households reported decline in household income because of the Easter floods (figure 5). In the Ainaro municipality, 100% of the households surveyed reported a decline in income. Liquica and Dili reported a 93% and 90% decline, respectively. 31% reported loss of income by less than a quarter, while 24% reported between quarter to half and 27% reported more than half decline of income.

Poverty remains largely a rural phenomenon in Timor-Leste, with 80% of the poor living in rural areas. However, the single largest cluster of poor people can be found in Dili, where around 15% of the poor live (80,000 people)[6]. The negative impact of the Easter floods, if not addressed with urgency, may further push these vulnerable households into abject poverty.

Figure 4: Main sector of employment for main income earner

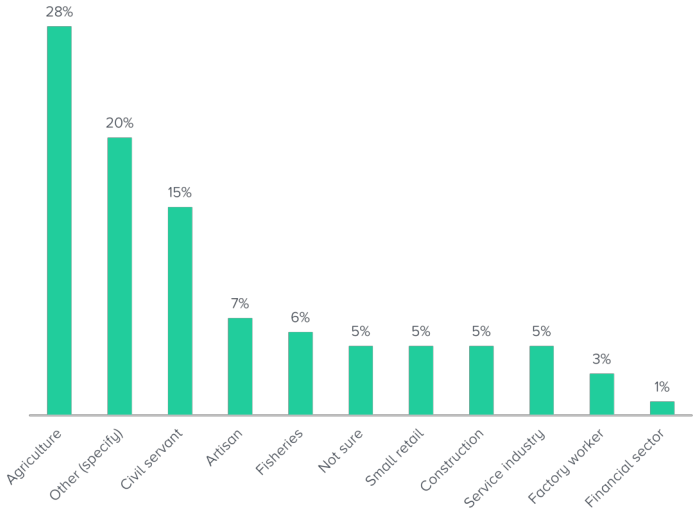
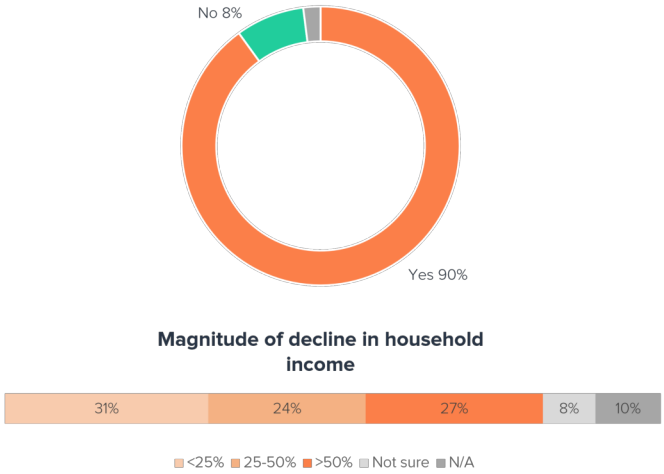


Figure 5: Household with decline in household income

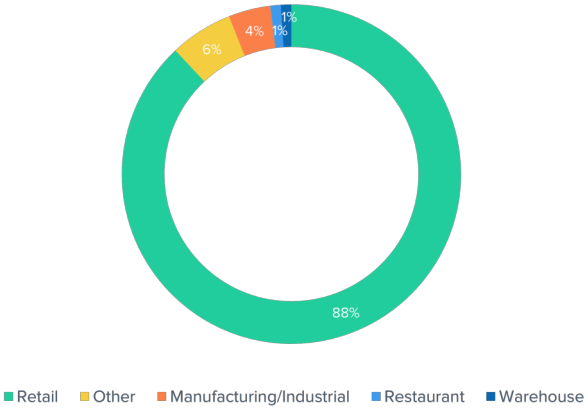


Of the 80 businesses interviewed, 88% of the businesses were reported as retail, while 4% were reported as manufacturing (figure 6). It is interesting to note that of the 80 businesses assessed, 59% of the business owners were female and 41% male. This demonstrates growing number of women entering small scale/retail business, an opportunity for the provision of targeted to support for furthering women's leadership and participation in the local economy.

Damage to equipment, damage to finished products, shortage/lack of raw materials and productivity decline were the most cited reasons for affecting business following the floods. While most male respondents reported damage to equipment as the main way in which their business was affected; female respondents reported shortage/lack of raw materials as the main reason for business being affected. 49% of the households reported that their businesses were affected but still operational, while 30% reported that their businesses were affected and no longer operational. 20% reported that their businesses were not affected.

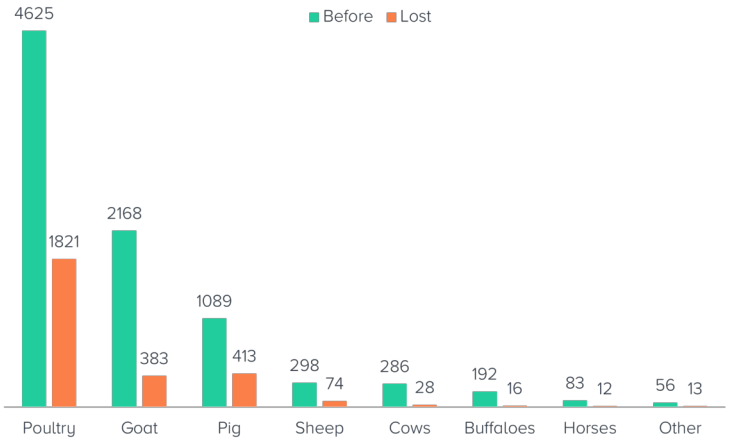
[6] *General Directorate of Statistics, Timor-Leste Standard of Living Survey (SLS-3) (2014/2015)*

Figure 6: Type of business



For the households which reported that their businesses have been affected by the floods and are not operational, 33% reported it would be possible to resume business within next 6 months, while 42% reported it was not possible for them to resume their business. Most damage to productive assets included: workshop (blacksmith, furniture etc.), raw materials/goods stock, household items, transport and fishing boats. Besides damage to productive assets, a total of 1,054 hectares of crop land (households surveyed) were reported as affected by the floods.

Figure 7: Number of livestock owned and lost due to the Easter floods



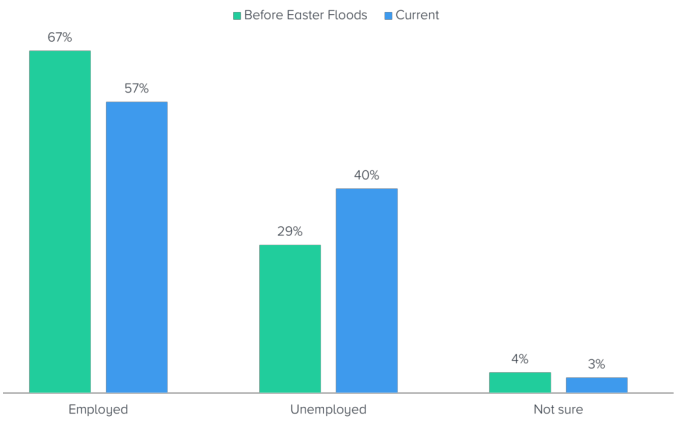
Poultry, goats, pigs, sheep, cows, buffaloes, and horses were reported lost to the flood (figure 7). Most poultry loss was reported from the four municipalities - Dili, Manatuto, Liquica and Ainaro.

Employment

The proportion of households' main income earners that were reported employed by the respondents, decreased by 10% (from 67% to 57% since the Easter floods). This high proportion of people without jobs will have severe impacts on the household income and local economy in a context where unemployment has been already very high. Even before the Easter floods, there were not enough formal jobs to meet the large number of people entering the labour market. In 2013, 22% of youth aged 15-24 were unemployed; 25% of young men and 17% of young women[7]. Young persons with a disability are also much more likely to be unemployed than youths without a disability (Census, 2015).

According to the 2019 World Bank gender poverty mapping study[8], the employment rate in Timor-Leste is highly gender-unequal across areas, with the employment rate of men significantly higher than that of women.

Figure 8: Employment rate before and after the Easter floods



[7] *General Directorate of Statistics, Timor-Leste Standard of Living Survey (2013)*
[8] *World Bank (2019d), A gender-sensitive insight of poverty mapping for Timor-Leste, Washington DC: World Bank*

Tropical Cyclone Seroja and the Easter floods occurred when Timor-Leste was facing a surge in COVID-19 cases, with Dili municipality under strict lockdown since 9 March 2021. The assessment team acknowledge difficulty in isolating post-floods impacts on employment and income vis-a-vis the COVID-19 pandemic. Therefore, the analysis should be considered in conjunction with the findings of the COVID-19 SEIA, currently in progress.

Income and food

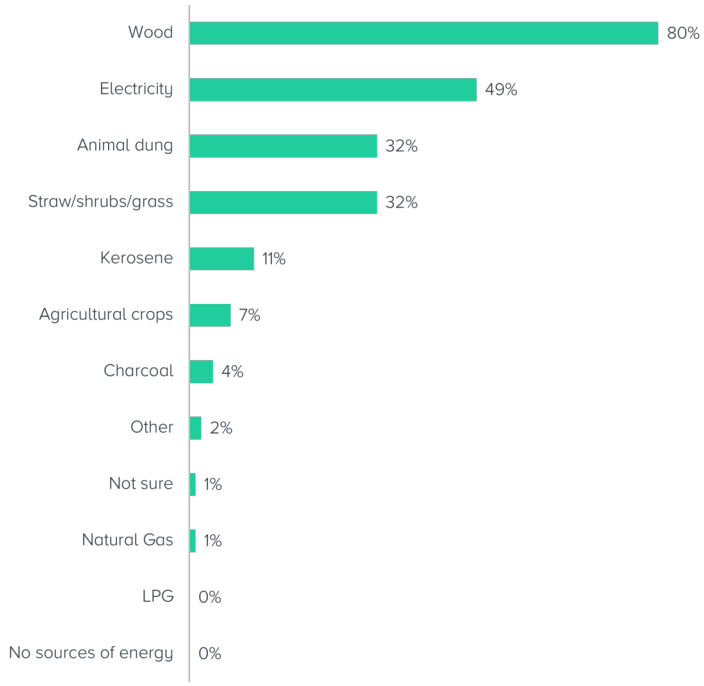
Malnutrition, food insecurity and poverty are intricately and multi-directionally linked: each contributes to the presence and permanence of others. On average, households in Timor-Leste spend almost 70% of their income on food, with poorer families spending even a larger component of their income on food. Agriculture productivity remains substantially lower in Timor-Leste compared to neighbouring countries with similar agro-economies[9].

During the HBDA survey, 22% of the households reported spending more than 50% of the income on food after the floods.

Sources of energy

Over 50% of the households use electricity and wood as sources of energy for cooking, heating and power, with 62% of the households in Dili using electricity as the main source of energy. In Ainaro, Liquica and Manatuto municipalities, over 90% of the households used wood as the main source of energy for cooking and heating (figure 9). Other sources of household energy include kerosene (12%), agriculture crops (7%), natural gas (1%) and LPG (1%).

Figure 9: Sources of energy for cooking, heating and power



Coping strategies adopted by affected households

Following the Easter floods, affected households adopted various measures to compensate for loss of income. These measures included – relying on less preferred, cheaper food (50%), reduced number of meals per day (21%), skipped meals (19%) and a reduced proportion of meals (19%). 17% of the households also reported consuming seed stock saved for the subsequent season to cope with loss of income. Besides these measures, flood-affected households adopted strategies to cope with the lack of food, or money to buy food, needed for the household. 42% of the households moved to live in another place, 22% borrowed money, 19% spent their savings, 17% reduced expenses on education and health, and 16% of the households sold increased amounts of livestock/poultry to cope with lack of food or money to buy food.

[9] *World Bank (2019a), Timor-Leste Economic Report 2019: Moving Beyond Uncertainty, April 2019: Washington DC: World Bank*

As mentioned above, the long-term impacts of the Easter floods should be considered in conjunction with the findings of the Inter-Agency COVID-19 SEIA currently in progress. The implementation of restrictions to contain COVID-19 pandemic have caused severe income losses, resulted in closure of businesses and firms and increased unemployment. The impact on local economy, due to health fence and "stay home" directives by the Government as part of COVID-19 restrictions, was further aggravated by the global impact of COVID-19 pandemic - disruptions in business and tourism, low demand for key export commodities including coffee contributed significantly to the decline in the economy.

Livelihood concerns and constraints to resume livelihood activities

Tropical Cyclone Seroja and the Easter floods have had profound impacts on the lives and livelihoods of the affected households. During the household survey, over 95% of the households reported being very concerned about their household livelihood conditions, while only 0.5% reported being not concerned. The affected households reported difficulties to restart their livelihood activities. The main constraints to restart livelihood activities included that livelihood assets were damaged (36%) and agriculture land remained under debris (12%) (figure 10).

Figure 10: Main constraints to restarting livelihood activity

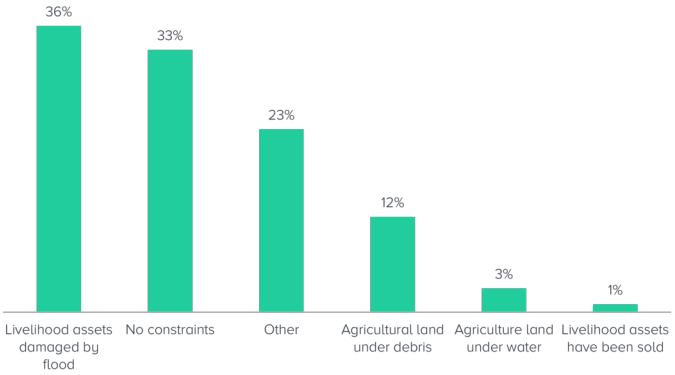


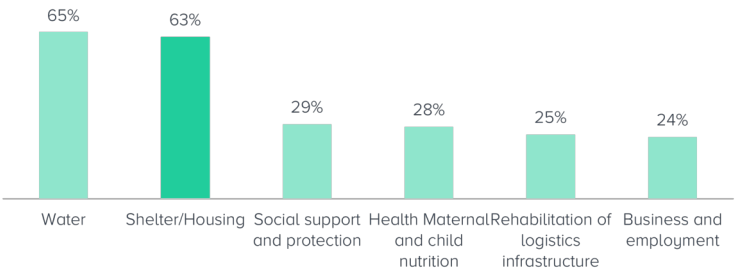
Figure 11: Agriculture land under debris, Manatuto municipality

Recovery needs prioritized by the affected households

Most households prioritized water, housing, social support, maternal health and child nutrition, rehabilitation of infrastructure and business/ employment as top recovery priorities (figure 12). Water was highlighted as priority by most households in Dili, Manatuto and Liquica, while households in Ainaro and Baucau prioritized the repair and reconstruction of housing, business and employment, and rehabilitation of infrastructure. Cash was reported as the preferred delivery of assistance followed by in-kind assistance.

Support was also requested for training and skill building for jobs and livelihoods, income replacement, information on employment opportunities.

Figure 12: Recovery priorities reported by the affected households



KEY FINDINGS – BUILDINGS DAMAGE ASSESSMENT

Settlements and Buildings Profile

Settlements have many different building typologies prone to varying degrees of damage in disasters. To understand the damage patterns, it is critical to study the building typologies in their settlement context. The HBDA survey covered different types of settlements in 5 municipalities, to gain an understanding of existing building typologies and materials, and the extent of damage incurred.

Within the context of Timor-Leste and the HBDA, distinct types of settlements were defined based on the following criteria:

- Settlements were considered 'urban' if located within city limits;
- Settlements were considered 'suburban' if situated on the periphery of city limits (suburban settlements usually have lesser density than the urban settlements and may have reduced access to basic utilities and services available in the city);
- Settlements were considered 'rural' if they were inland, and in close proximity (or not) to forests, with most of their population engaged in farming; and,
- Finally, settlements situated on the coast, with a significant number of people engaged in fishing, were considered 'coastal'.

Most of the buildings identified for the HBDA through the sampling strategy discussed earlier in the methodology section were in either rural (41.3%) or suburban (37.9%) settlements. The distribution of buildings surveyed in different municipalities and type of settlements is indicated in figures 13 and 14.

Figure 13: Municipality-wise distribution of the surveyed buildings

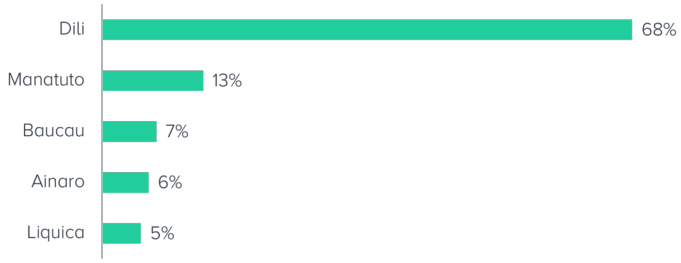
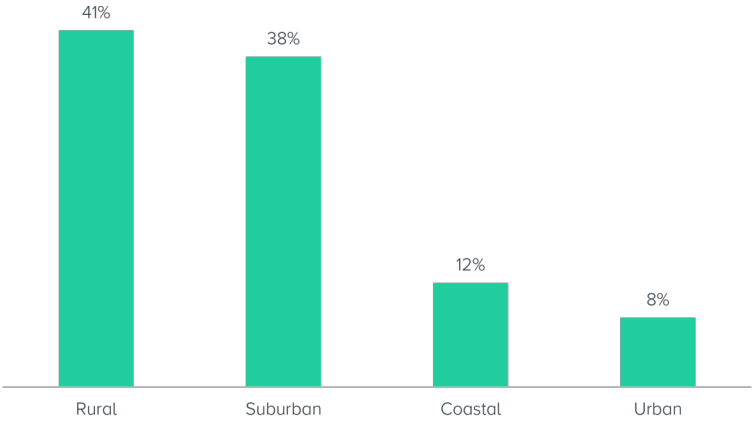
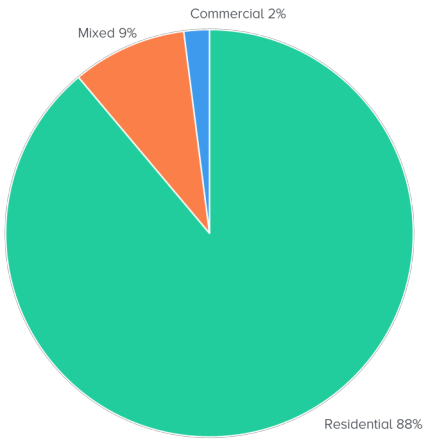


Figure 14: Settlement-wise distribution of the surveyed buildings



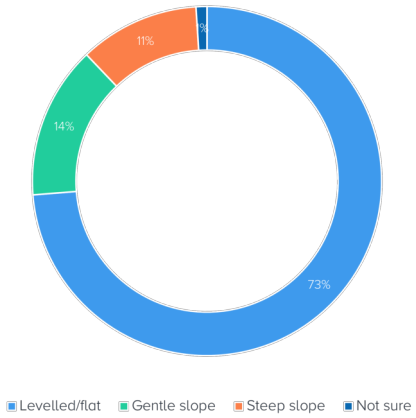
Approximately 88.3% buildings surveyed are used for residential purposes, 9.5% for commercial purposes, and the remaining 2.2% are mixed-use. (refer figure 15)

Figure 15: Distribution of buildings by use



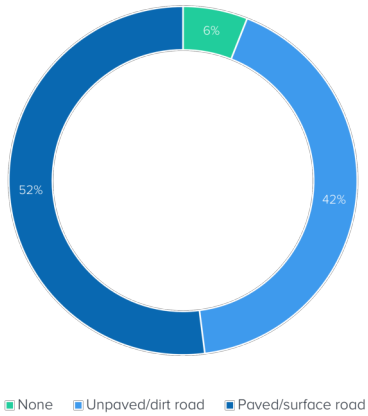
The slope of the building sited varied. The grading of sites can be indicative of the risk factor to various natural hazards, including floods and landslides. The HBDA survey found most of buildings were situated on levelled ground or gentle slopes. However, approximately 11% of buildings were built on steep slopes. Figure 15 illustrates the varying slopes of building sites assessed. While most sites were levelled, they were also low-lying and, hence, impacted by flooding.

Figure 16: Grading of the building sites



Access to roads is not only important for enabling basic services, but also serves as critical infrastructure for disaster risk mitigation. It is important that the building occupants can access and exit sites during times of crisis. 6% buildings lacked such access points, while 42% could only be accessed through a dirt/ unpaved road. Figure 16 summarises the status of access roads to the surveyed buildings.

Figure 17: Type of access to the buildings surveyed



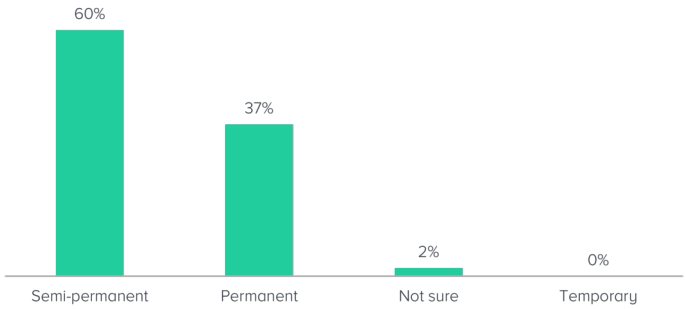
The extent of damage varies according to a building's typology, owing to the differing performance of materials and built structures. Building typologies must be understood based on their foundations, walls and roofing materials. In the context of the HBDA, the following categorisation was used to understand the walling based on materials.

- The 'Permanent' category included buildings with walls made of concrete blocks, bricks or stone. These materials are long lasting and do not need to be replaced if regular minimal maintenance is undertaken;
- The 'Semi-permanent' category includes light-weight materials which are not appropriate for a comfortable housing but don't require frequent maintenance. Used primarily for their cost effectiveness, semi-permanent materials may include corrugated galvanised iron (CGI) or other cement or polymer based corrugated sheets. Semi-permanent category also includes hybrid walls, where two different materials like concrete blocks and CGI sheets may have been mixed; and,
- The 'Temporary' category included walling materials that have short lifespan and require frequent replacement and maintenance such as wattle & daub, tarps, etc.

The above categorisation is based primarily on the type of materials used, and does not consider the way in which buildings are constructed. Vernacular and traditional buildings using many materials like bamboo, thatch, palm sticks, or other vegetative materials, in a variety of ways which could change the performance of the buildings in different hazards.

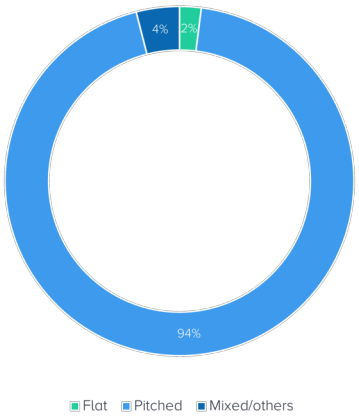
More than 60% of the surveyed houses fall in the category of semi-permanent typology. Corrugated Galvanised Iron sheets remain the predominant material for the walls for most of the surveyed buildings. Based on the walling materials, the building typologies are represented in figure 18.

Figure 18: Building typologies by the walling materials



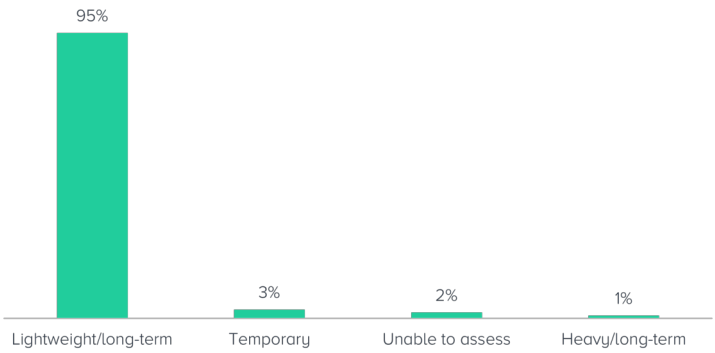
Most surveyed buildings (94%) have pitched roofs and only about 2% buildings had flat roof. Figure 19 indicate the profile of the buildings based on the roof type.

Figure 19: Building typologies based on the roofing type



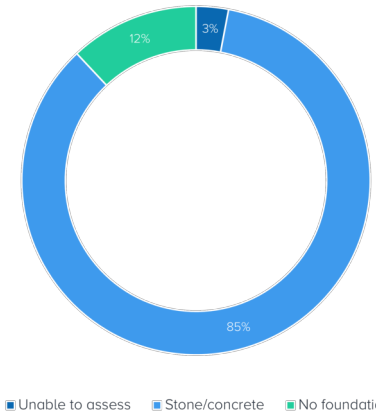
The roofing material is indicated in figure 19 below. Lightweight but long-term roofing materials include CGI or other type of polymer or cement-based roofing sheets. Majority of the surveyed buildings (94.5%) used such roofing sheets. Heavy roofs are essentially Reinforced Cement Concrete (RCC) roofs (0.5%) and were few. This might be due to high costs involved when building with RCC. Temporary roofing materials include thatch, sod or other vegetative materials which require frequent replacement and maintenance.

Figure 20: Building typologies by the roofing material



A building's foundations are an essential element without which permanent buildings could not be possible, and even temporary buildings would be highly vulnerable to hazards. This survey did not assess the adequacy or strength of the foundations, but merely noted whether foundations exist. More than 12% of buildings do not have foundations and only timber of bamboo posts may be embedded in the ground on which walling material is fixed. No foundation will also mean no plinth. Figure 21 illustrates the existence and type of building foundations.

Figure 21: Building typologies by the foundation type



While 60.4% buildings have semi-permanent walls, 96.7% buildings have light-weight sheet roofs. The most predominant typology of the buildings (47.5%) is a combination of semi-permanent walls with lightweight sheet roofs. These are low-cost and poor-quality houses. These types of building indicate that the most-affected households are economically weak. Only 0.5% of buildings have permanent walls with RCC slab roofs. Permanent-type buildings are in urban or suburban settlements. In some hilly regions, stone walls may be found in old vernacular buildings. Vernacular houses using bamboo, palm sticks and thatch are reducing slowly and stilted houses are rare. Some specific structures within the house, such as granaries, might have continued to be elevated on small stilts, but use of stilted living spaces in the houses has become rare now. The use of industrial

material, particularly CGI and polymer sheets, is increasing and becoming a typology in itself. However, the actual desirability of such building typologies necessitates a separate discussion. Figures 22 and 26 explain the distribution of building typologies.

Figure 22: Various building typologies (%age) in the disaster-affected areas

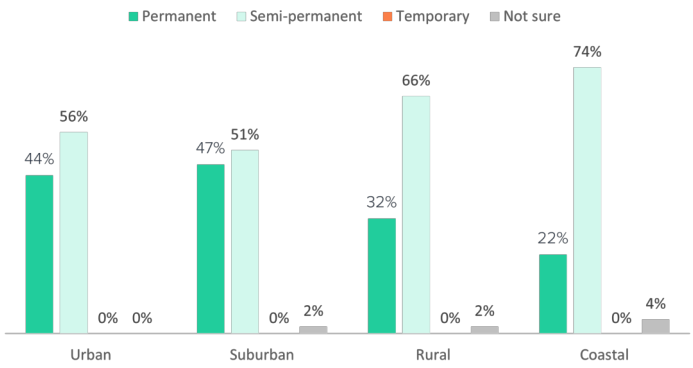
Wall type	Foundation type	Roof type Lightweight sheets	RCC flat roof	Temporary
Permanent	With foundation	35.5	0.5	0.1
	No foundation	0.4	0	0
	Not sure	0.9	0	0
Semi- Permanent	With foundation	47.5	0	0.3
	No foundation	9.4	0	2.4
	Not sure	0.8	0	0
Temporary	With foundation	0.1	0	0
	No foundation	0	0	0
	Not sure	0	0	0
Not sure	With foundation	0.2	0	0
	No foundation	0.3	0	0
	Not sure	1.6	0	0
		96.7	**0.5**	**2.8**

Figure 23: Concrete block walls with CGI sheet roof (permanent)

Figure 24: CGI sheet walls with CGI sheet roof (semi-permanent)

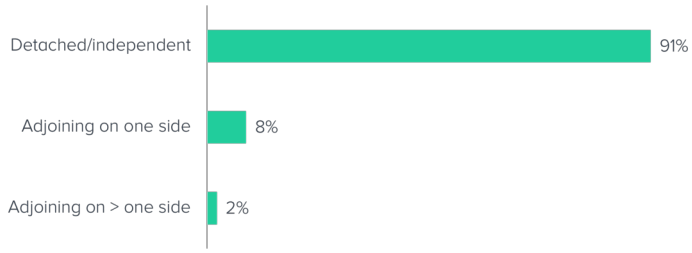
Figure 25: Wattle & Daub walls with thatch roof (temporary)

Figure 26: Settlement-wise Building typologies (%age)



According to figure 27, most of the buildings (90.6%) are detached and independent structures. Approximately 9.4% buildings were adjoining to other structures on one or more sides. This indicates that damage to one structure doesn't increase impact on the other buildings, in most cases.

Figure 27: Proximity of the buildings to other buildings



Nearly 98% of the buildings were single-storey structures and only about 2% of buildings had two or more storeys. Figure 28 summarizes the building storeys.

Figure 28: Number of storeys

Building Damage

The Easter floods have caused widespread damage. The HBDA showed about 80% of the surveyed buildings had suffered some structural damage. About 12.7% buildings are fully collapsed and 8.8% are severely damaged. Majority of the surveyed buildings had minor to moderate structural damage. Damage to the structural elements such as foundations, walls and roof was considered structural damage. Meanwhile, damage to the floor and ceiling generally would not result in collapse of the structure, as these components are non-structural. Damage to the floors and ceilings was not considered life-threatening. With the intent to prioritize essential information, the HBDA mainly analysed data on structural damage. The following figures 29 and 30 summarises the extent of structural damage in the surveyed buildings.

Figure 29: Extent of structural damage to buildings

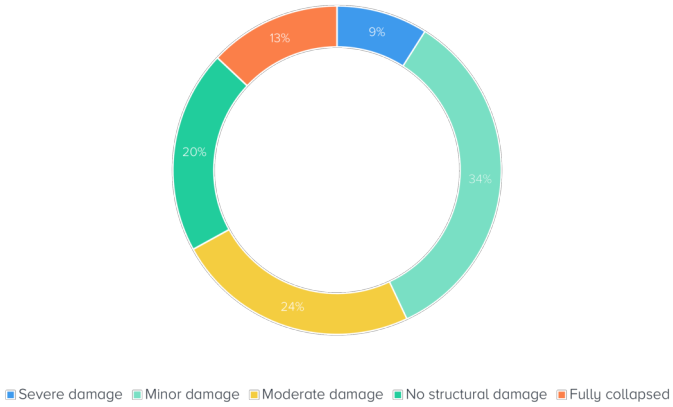
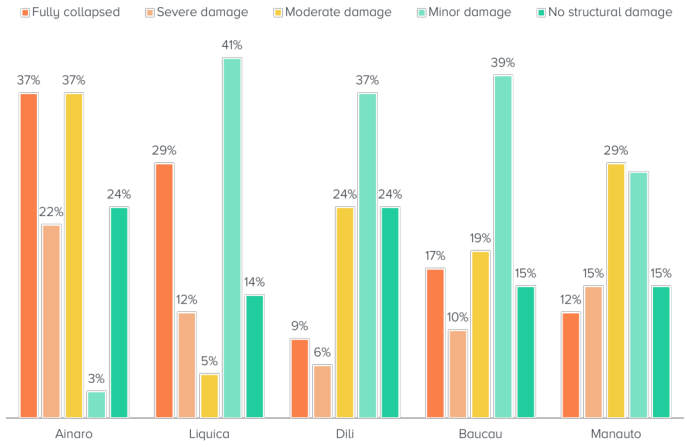


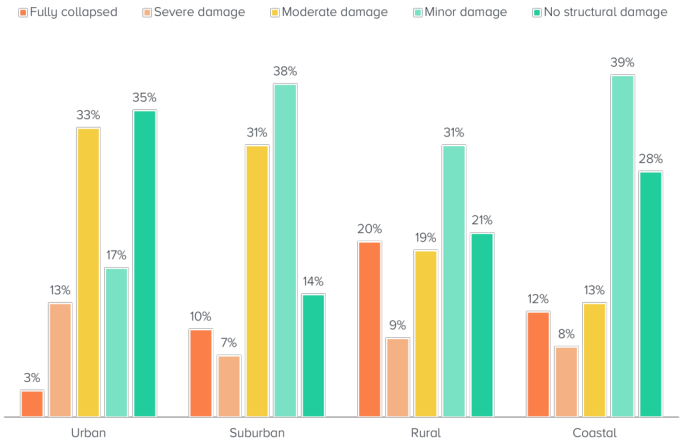
Figure 30: Municipality-wise buildings damaged (%age)



From figure 30 above shows that the extent of damage is much higher in Ainaro with nearly 59.3% of the surveyed buildings as severely damage or fully collapsed. While it is not statistically representative, it seems the damage to the surveyed buildings in Ainaro is much higher, while in Dili, the majority of buildings (61%) have suffered minor to moderate damage. Within these municipalities, the severity of structural damage seems to be much higher in rural and coastal locations. Amongst the surveyed buildings,

the proportion of fully-collapsed buildings was higher in rural or coastal locations, whereas the damage in suburban and urban settlements seems to be comparatively lower. Figure 31 summarizes the extent of damage for different settlement types.

Figure 31: Extent of structural damage (%age buildings) by settlement types



The following figure 32 shows the extent of damage across different buildings' use. Though it appears that commercial buildings have collapsed more proportionately, one cannot draw such particular inferences, owing to the small sample size.

Figure 32: Extent of damage (%age of buildings) by use

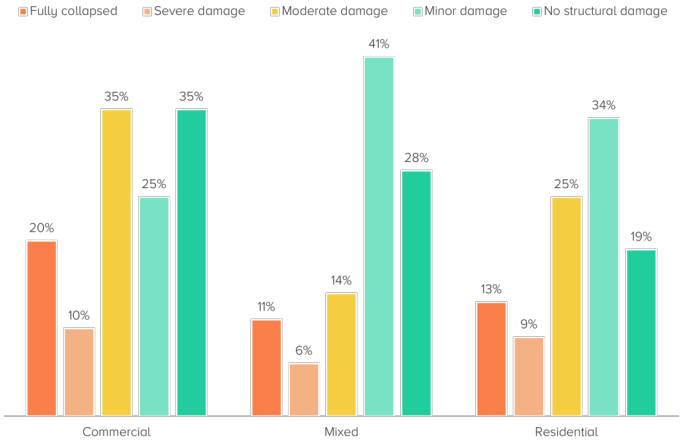


Figure 33: A concrete block house collapsed

Figure 34: A damaged CGI sheet house

Figure 35: A collapsed temporary house

Figure 36: A semi-permanent type house damaged

Permanent buildings are generally expected to perform better in disasters than semi-permanent and temporary buildings. As the data shows, permanent buildings were not as much damaged as semi-permanent or temporary buildings. Amongst the surveyed buildings, a total of 23% of semi-permanent buildings were damaged, while only 14% of permanent buildings were damaged. Figure 37 summarizes the damage typology wise.

Figure 37: Building typology wise structural damage

Typology	Total Buildings	Damaged Buildings	%age
Permanent	347	47	14
Semi-permanent	580	135	23
Temporary	1	1	100

The degradation of materials and construction is possible with age. This can impact the performance of buildings during disasters and can worsen the extent of damage. The following table shows the distribution of the surveyed buildings by age. 65.7% of buildings were relatively young and had been constructed less than 10 years prior. As most buildings are semi-permanent type, it is likely that that rates of replacement and renewal are high in addition to the new housing stock.

Figure 38: Age of buildings

Building age	Number of buildings	%age
< 10 years	610	65.7
10 to 20 years	168	18.1
20 to 30 years	99	10.7
>30 years	47	5.1
Not sure	4	0.4

Figure 39 presents extent of damage in relation to the age of buildings. It shows fully-collapsed houses to be less in buildings with less than 10 years old or more than 30 years old. As this presents a perplexing picture, a Pearson's Chi Square test was undertaken to test for the significant in differences of proportion of houses in different age groups that were damaged. Low (less than 0.05) values of p statistic presented shows that the proportion of houses that had damage varied across age groups for most categories of damage (except for severe damage).

Figure 39: %age of buildings damaged considering building age

Building age	Fully collapsed	Severe Damage	Moderate damage	Minor damage	No damage
< 10 years	10	7.9	21.8	36.2	24.1
10 to 20 years	22	8.9	25.6	29.2	14.3
20 to 30 years	15.2	12.1	37.4	24.2	11.1
>30 years	10.6	12.8	27.7	40.4	8.5
Not sure	15.2	12.1	37.4	24.2	11.1
p-value	**0.0005**	**0.3989**	**0.0087**	**0.0426**	**0.0003**

To understand this relationship between age and the extent of damage further, building typologies were looked into. Figure 40 shows the distribution of building typologies (walls) with the age of the buildings. This shows the proportion of permanent-type buildings to be higher in recent buildings (less than 10 years) and older buildings (more than 30 years). This explains why the proportion of buildings that faced complete collapse was lower in these two categories of age.

Figure 40: %age of building typologies (walls) distributed age wise

Building age	Permanent	Semi-permanent	Temporary	Not sure
< 10 years	39	59	0	2
10 to 20 years	35	61	0	4
20 to 30 years	30	69	0	1
>30 years	43	57	0	0

Building damage had resulted in a large quantity of debris. While not all building damage resulted in debris, it was noted in approximately 28% of the damaged buildings. A total 4713.4 m^3 of debris was needed to be managed and disposed of in an environmentally safe way.

Figure 41: Concrete debris

Figure 42: Miscellaneous (wood, CGI sheets, bamboo) debris

In addition to building debris, there is also significant debris from landslides in many hilly locations, particularly in Ainaro. The quantity of landslide debris is not estimated and is overwhelming in certain locations.

Figure 43: Houses destroyed due to the land slides

Impact on Building Services

Damage to building services, in addition to housing, severely limits the quality of life of affected households. Three key services – drinking water, toilets and electricity – were included in the HBDA to understand the impact of the Easter floods.

Drinking water

Respondents reportedly used multiple sources for their drinking water needs before the floods. Public taps/ standpoints and tanker water constituted the predominant sources, covering 48% of the households. Another approximately 19% of households access water from the rivers, lake, ponds, streams or springs. Other sources remain dug wells, tube wells and bore wells. Drinking water scarcity is a critical issue even in the normal times, disproportionately affecting women who haul water across long distances to cater to their family's needs. The floods worsened access to water for more than 30% of households, as many sources of supply were affected. Households' dependent on tanker water supply (58.8%) and the public taps/ standpoints (29.6%) were the most affected. The following figure 44 explains the status of access to various water sources.

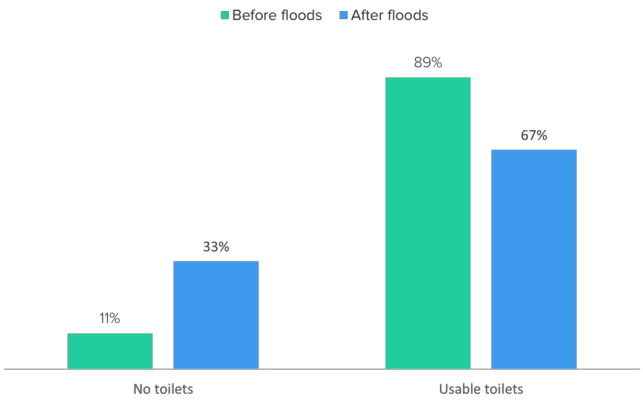
Figure 44: Access to water sources and impact of the floods

Source of Drinking water	Total households (%)	Affected households %age of total households
River/ Lake/ Pond/ Stream/ Spring	19.1	22
Dug well	9.6	14.6
Tubewell/ Bore well	16.5	15
Public taps/ standpoints	26.6	29.6
Tanker water	21.4	58.8
Not sure	6.8	28.6

Toilets

Access to toilets was seriously affected due to the floods. While nearly 11% households were practicing open-air defecation prior to the floods, this number increased after the floods. The households without access to toilets almost tripled from 10.7% to 32.7%. It is likely that toilet waste disposal, predominantly pit-based systems, was affected due to flood waters entering the soakage pits and rendering them useless. Figure 45 indicates impacts on access to toilets for the buildings surveyed.

Figure 45: Change in access to the toilets



Electricity

Main electricity grid is the predominant source of supply for most buildings, and was seriously affected. 71% of the buildings connected to main grid faced problems. People having access to solar power were not affected by floods and continued having uninterrupted supply. Figure 46 summarises the affected electricity supply by the source type.

Figure 46: Affected electricity supply to the buildings

Source of Electricity Supply	Total no. of buildings	%age proportion affected
Main electricity grid	822	71
Neighbourhood generator	45	40
Large batteries	10	60
Solar power	7	0
Not sure	24	79
No electricity	20	0

Cross cutting issues

Vulnerability to Natural Hazards

Timor-Leste is identified as 15th country most at risk in the world to natural hazards as a result of its location, geography and very limited capacity to prepare for and recovery from climate-related shocks (World Risk Index 2019). Timor-Leste is vulnerable to earthquakes and associated hazards, such as tsunamis, due to its geographical location which is north of the subduction zone between the Eurasian and Australian plates. It experiences the El Niño/ Southern Oscillation (ENSO) related weather anomalies associated with droughts in this region occurring in cycles every couple of years. It is prone to floods, landslides and erosion resulting from the combination of heavy monsoonal rain, steep topography and widespread deforestation. In addition to El Niño, the La Niña weather phenomena also has had a significant impact on Timor-Leste communities, both positive, in terms of improving agricultural production and water security, and negative in terms of increased flooding, landslides and erosion. Climatologists predict that, due to climate change, Timor-Leste is likely to become increasingly vulnerable to cyclones, tropical storms, floods, landslides and vector born diseases such as Malaria, Dengue and other emerging infectious diseases[10].
Disasters and the effects of climate change have significantly adverse impacts on the most vulnerable and poorest, as observed from the recent Easter floods.

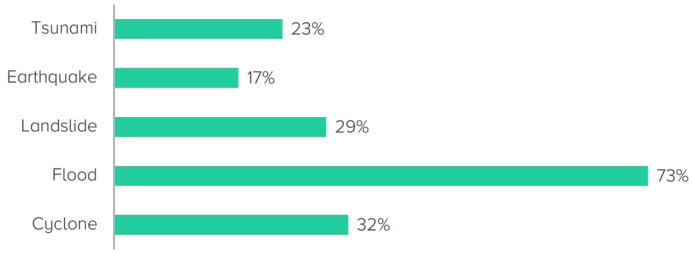
Figure 47: Landslide, Ainaro municipality

[10] *National Disaster Risk Management Policy, March 2008.Secretary of State for Social Assistance and Natural Disasters, Ministry of Social Solidarity.*

"I am 70 years old, I have never seen such heavy rain in my life. My neighbor with family of five along with their house were buried by landslide. I feel unsafe." – Ms. Rosa, suco Maulao, Ainaro

During the HBDA survey, most households reported being vulnerable to flooding (73%), followed by cyclones (32%) and landslides (29%). Other natural hazards that households perceive to be vulnerable to, include tsunami and earthquakes (figure 48).

Figure 48: % of households reporting vulnerability to natural hazards



Key Informant Interviews with some affected households and Suco Chiefs point to the fact that there was differential access to cyclone early warning before Tropical Cyclone Seroja. While some Suco Chiefs were proactive and took anticipatory actions following early warning received through Indonesia TV channel and the Timor-Leste Meteorology WhatsApp group and relocated vulnerable people to safe locations, populations in remote locations such as Maulao in Ainaro municipality had no access to early warning. The post-flood recovery process should integrate disaster risk management and step-up early warning system in vulnerable locations.

Figure 49: Bridge damaged by Easter floods, Baucau

"This suco has Tara Bandu (local forest regulation). But no support for implementation. Policies should be strengthened along with technical support for implementation – at the sub-aldeia, aldeia level." Suco Chief, Vemasse Tasi, Baucau

Figure 50: House and kiosk damaged by flood waters, Dili municipality

Gender

Although women in Timor-Leste predominantly work in the agricultural sector, (56% of employed women), women only make up 26% of wage employment (employees) in agriculture (Census, 2015). According to the 2019 World Bank gender poverty mapping study the employment rate in Timor-Leste is highly gender-unequal across areas, with the employment rate of men significantly higher than that of women[11]. In order for women to fully participate in the economy, it is integral for women to engage in wage employment in a variety of sectors across the economy and have access to credit and banking. The HBDA reveals increasing numbers of women in the small/retail business. Out of the 80 businesses assessed, 59% of the business owners were female and 41% male. The impacts of the Easter floods on businesses were also felt differently by men and women. While most male respondents reported damage to equipment as the main way in which their business was affected; female respondents reported shortage/lack of raw materials as the main reason for business being affected. This differential impact of the floods and recovery needs should be incorporated in the recovery assistance by the Government and humanitarian agencies.

Persons with disability

Timor-Leste's Constitution guarantees non discrimination and equal treatment for all people, regardless of gender or mental or physical disabilities. A National Policy on the Inclusion and Promotion of the Rights of Persons with Disabilities was adopted in 2012. The 2016 National Youth Policy specifically identifies young people with disabilities as a priority target group for support. Despite these commitments, gaps remain.

People with disabilities are often 'invisible' in their communities, and discrimination and stigma is widespread. There is evidence of shackling and restraining of children and adults with disabilities, particularly those with psychosocial impairments[12]. A mixture of religious and animistic attitudes can perpetuate negative discourses of disability, seeing a person's impairment as a result of tolok (curse), or punishment from God or ancestor spirits[13]. These attitudinal barriers, combined with other factors such as physical inaccessibility, lack of accessible transport and lack of information, indicate that the basic needs and fundamental rights of people with disabilities are not being met. The 2010 census found that 72% of people with disabilities had never attended school. A 2013 study found that discriminatory attitudes of healthcare workers, inaccessible health facilities and lack of knowledge about available services mean that people with disabilities in Timor have unmet health needs[14]. Recent interviews undertaken by the national disabled person's organisation, Ra'es Hadomi Timor Oan, found that, of 49 women with disabilities across the country, 65% do not work or engage in livelihood activities, leaving them reliant on family or community members[15].

This HBDA reports that 15% of the households have one or more members with a disability, while 14% of heads of the households reported having some form of disability. Coordinated action is needed to overcome barriers and challenges faced by people with disabilities. Government, development partners and broader society should ensure mainstream development interventions are inclusive of the people with disabilities. Without this targeted approach, people with disabilities will be left behind, and Timor-Leste will not be able to meet its commitment to achieve the Sustainable Development Goals by 2030.

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[11] World Bank (2019d), A gender-sensitive insight of poverty mapping for Timor-Leste, Washington DC: World Bank

[12] UNMIT (United Nations Integrated Mission in Timor-Leste) 2011. Of Course We Can: Report on the Human Rights of Persons with Disabilities in Timor-Leste.

[13] Joaozito Dos Santos and Elizabeth Morgan 2016. Steps Towards Achieving Inclusion for People with Disabilities in Timor-Leste; State, Society, Governance in Melanesia, Celebrating 20 years of SSGM and 70 years of Pacific Studies at the Australia National University.

[14] McCoy, M., C. de deus Gomes, J.A. Morais and J. Soares 2013. Access to Mainstream Health and Rehabilitation Services for People with Disability in Timor-Leste: Situational Analysis. AusAID.

[15] RHTO (Ra'es Hadomi Timor Oan) 2015. RHTO Submission to the CEDAW Committee

CONCLUSION

Tropical Cyclone Seroja and the Easter floods affected 30,367 households across all 13 municipalities with over 81% of the affected households in Dili municipality (Situation Report 10, UN RC office, 18 June 2021). Flash floods caused landslides, damage to houses, buildings and public infrastructure including sections of highways and city roads. A total of 2,660 hectares of agriculture land were affected by the floods, including loss of poultry, livestock and other livelihoods assets.

Five municipalities - Dili, Liquica, Manatuto, Baucau and Ainaro - were selected for the HBDA based on the findings of the Multi-Sector Rapid Needs Assessment conducted by the Secretary of State for Civil Protection. Based on the findings from the HBDA, the following conclusion is presented.

Livelihoods

- Agriculture is the main sector of employment and source of income for households in Timor-Leste (Census 2015, HBDA 2021). Other livelihoods include Government service and small business.
- The Easter floods has severely affected livelihoods of the population in Dili and other municipalities – Manatuto, Liquica, Baucau, Ainaro.
- 90% of households reported a decline in household income as a result of the Easter floods.
- Negative coping strategies adopted by affected households included a reduced number of meals per day; the consumption of seed stock; borrowed money; reduced expenses on education and health; and the selling of livestock/poultry more than usual to cope with lack of food or money to buy food.
- Over 95% of the households are very concerned about their household livelihood conditions.
- The main constraints to restart livelihood activities included - livelihoods assets damaged, agriculture land under debris and agriculture land under water.
- Without immediate livelihood recovery support, the flood-affected vulnerable households will be unable to resume their livelihoods and will require prolonged humanitarian assistance. For the households who reported their business have been affected by the floods and not operational, 42% reported it was not possible for them to resume their business. Besides the damage to business and productive assets, a total of 1,054 hectares of crop land (840 households surveyed) were reported as affected by the floods.
- Floods, cyclones, landslides, tsunamis and earthquakes were reported as the main natural hazards to which the communities are vulnerable. Timor-Leste is identified as 15th country most at risk in the world to natural hazards as a result of its location, geography and very limited capacity to prepare for and recovery from climate-related shocks (World Risk Index 2019).

Housing

- Tropical Cyclone Seroja caused excessive rains which in turn led to flooding. Excessive rains also caused landslides in hilly regions. Therefore, the buildings were damaged due to high winds, floods, as well as landslides. While floods due to rivers breaching their embankments was major cause in coastal regions, landslides or flash floods were the significant causes of the damage in the hilly region. It is also likely that the damage was a result of multiple hazards in some cases. The hazard risk profile depends on location and geography.
- Most of the damaged buildings surveyed during the HBDA were single storey, detached independent, semi-permanent structures. This seems to be the most pre-dominant building typology. The walls and roof are made of lightweight sheets or other type of panels (ply-board or other polymer-based sheets). In some cases, the walls may be partially constructed using concrete blocks or stones.

The roofs are mostly Corrugated Galvanised Iron (CGI) sheets. These sheets are typically fixed on timber or bamboo under structure for the roof and vertical posts for walls. Nearly 60% of the buildings were of this typology. The remaining 37% had stone or concrete block walls and were categorised as permanent buildings. Buildings having walls and roofs of vegetative materials like thatch or wattle & daub were categorised as temporary.

- Proportion of the vernacular type of buildings is declining. Though categorised as temporary due to the type of materials used in these buildings, it is very much possible to enhance the life of the building by using these materials in better ways. Such skills and crafts might be not easily available for ensuing the structural design and construction in ways that enhance the age and reduce damage risks in future.
- The fully collapsed buildings were less if built in last 10 years or were older than 30 years. Data also shows that the proportion of permanent type of buildings was more in these age groups. While building typology might have been a critical factor for the extent of damage, the relation between age of the building and extent of damage is not clear.
- Almost 12-15% of the buildings didn't have any foundations or plinth. Timber, bamboo or concrete posts are just embedded in the earth in many cases. Such structures remain highly vulnerable and prone to damage in floods due to scouring.
- Even though overall number of buildings damaged in Ainaro may not be as large as Dili, the extent of structural damage seems to be the more severe. Nearly 59% of the surveyed buildings had suffered the severe damage or collapsed. While the structural damage in Dili was between minor to moderate (60%). About 24% of buildings in Dili had not suffered any structural damage. Within these five municipalities, the severity of structural damage was comparatively higher in the buildings in rural and coastal locations.
- Building services particularly drinking water, toilets and electricity were badly affected. Drinking water supply is limited even in normal times and a large number of households depend on public taps or tanker water supply. These services were badly affected in the aftermath of disaster. Nearly 11% of population didn't have access to toilets before the floods and this number tripled afterwards. This is a significant public health issue. Similarly, the households dependent on electricity supply from the main grid were the worst affected. The floods also indicated the resilience of households who had solar panels installed. The power supply was not affected for them.

RECOMMENDATIONS

Recovery Needs based on the HBDA findings

The following livelihood recovery interventions are recommended based on the HBDA findings.

Immediate (within next six months)

- Provision of tap water in urban area (for household needs like bathing, washing, cooking). Lack of adequate access to water remains high particularly in urban area in Dili and Manatuto.
- Provision of seed stock for farming households as they have consumed their seeds to cope with the post-floods situation. (E.g. Bacau, Manatuto – just harvested crops were washed away and grain storage facility were damaged along with the food grain/seeds.
- Flood-resistant grain/seed storage facility/method to be promoted.
- 90% of households reported reduction in income after the floods. Support for restoration of business for the affected households (30%). Livestock re-stocking/cash grant for affected households in Manatuto, Dili (mostly poultry), Liquica (poultry, pig, goat).

- Support for restoration of livelihoods (replacement of livelihoods assets). Urgent support for restoration of livelihoods to prevent negative impacting coping practice as being reported by the affected households. 95% of the households are very concerned about livelihoods conditions.
- Top recovery priorities reported by the affected households – repair and reconstruction of damaged house; access to clean water; employment and income opportunities.

Medium and long-term (1 to 3 years)

- Floods are increasing in frequency and intensity (also impacted by climate change); diversification and flood-resilient livelihoods to be supported.
- In the medium and long-term, Government and development partners need to foster public-private partnerships and promote creation of sustainable jobs for the fast-growing working-age population.
- Develop a communication strategy on how to mitigate impact of flooding and landslides (especially as these events are increasing in intensity and frequency).
- Introduce disaster risk management in school curriculum. Promote community-based disaster risk management and preparedness.
- Considering the increasing risk to hazards, such as cyclones, floods, landslides, and tsunamis, there is an urgent need to develop appropriate early warning systems within Dili as well as vulnerable sucos in other municipalities. Some work has already been initiated by the Secretary of State for Civil Protection together with partners, including the European Union, the Korea International Cooperation Agency, Similie and Mercy Corps on installation of flood Early Warning System in Dili.
- *Disability inclusion:* While the HBDA provides broader-level data, comprehensive data is needed to inform policy and programming decisions. Mainstream data collection efforts must be disaggregated by disability using internationally agreed approaches that are made culturally and linguistically appropriate to the Timorese context. Most importantly, all mainstream livelihood and employment programmes must consider and include people with disabilities.
- *Gender equality and empowerment of women:* The post-flood recovery process must be seen as an opportunity by the Government, development partners and the affected communities to build back better. Recovery efforts should address the differential impact and recovery needs of women and men. Focus on resumption of small business/retail where women are found to be in majority, including provision of cash assistance package for recovery and resumption of other livelihoods. Training and financial inclusion of women to be prioritized during the recovery process.

Housing

Natural hazards are recurring events. The Easter floods, though unprecedented, should not be taken as something that would never occur again. Climate risks are increasing and communities particularly the poor and marginalised are becoming more vulnerable. The way forward is to recognise and understand the risks, vulnerabilities and strengthen the capacities. HBDA tells us specific issues that need to be dealt with to ensure resilient buildings and communities.

- The building performance when faced with floods, cyclonic winds or landslides depends on certain disaster resistant features. These include quality of materials, structural systems, and construction technology. HBDA showed that a large number of houses do not just have disaster resistant features missing but are poorly constructed. It is necessary to incorporate the appropriate disaster resistant features as per the applicable building codes.
- Locations prone to cyclonic winds, floods or landslides need to be mapped and included in the development plan of the municipalities. Considering locational hazards, risk sensitive land use planning is critical as many houses

were damaged due to landslides in hilly region. It is important to assess slopes to be used for construction and to improve methods of terracing,

- Overall pre-dominant semi-permanent housing made of CGI or other polymer based corrugated sheeting is indicative of the poor affordability of households. There is need to support housing with better materials and technology. For this, capacities of local communities need to be strengthened. Better materials do not mean the modern industrial materials only. There has been considerable research and practice with the traditional materials and technologies to building structures considering the locational hazard risks and that are more resilient during disasters.
- Housing in Timor-Leste is largely self-built by the owners. People buy their own materials, mobilise support through their own community network, hire skilled labour, self-manage the construction site, and supervise their own construction. Therefore, it is necessary their own capacities in terms of information, knowledge and skills is strengthened to incorporate disaster resilient features.
- As these houses are small and are built without any professional engineering inputs, it is necessary to develop simple building guidelines and norms that can be easily understood and followed by the house owners and local artisans. Building guidelines should cover all various building typologies including the vernacular traditional and the modern industrial.
- Traditional forms of construction involved labour sharing and community cooperation, whereas newer typologies are more market-based. It is important to facilitate various options that people want to build with. Facilitation support should be available for various typologies.
- HBDA shows that while some families need to reconstruct new houses, majority of buildings need repairs and retrofitting. So, the housing recovery program needs to include both - reconstruction as well as repairs and retrofitting. There will be need to conduct a census survey to identify the buildings needing reconstruction or repairs. After so many months of the disaster event, such a process may be challenging and appropriate criteria and methodology would be required for identification of eligible households.
- As mitigation of damage risks of flooding and landslides may also require some site level improvements, the recovery support must include provisions and facilitation for the same. Such mitigation measures may be identified and implemented through a participatory process involving local communities and relevant technical experts,
- Access to basic services is very limited. Supply network systems for the services do not have adequate reach or resilience. Even normal time access to services need to improve. There is need to ensure resilient infrastructure and basic services for the house owners particularly for drinking water needs, sanitation, and electricity, Decentralised systems have proven to be more resilient than centralised systems. Community based systems to access basic services have the potential that could be utilised for the greater outreach.

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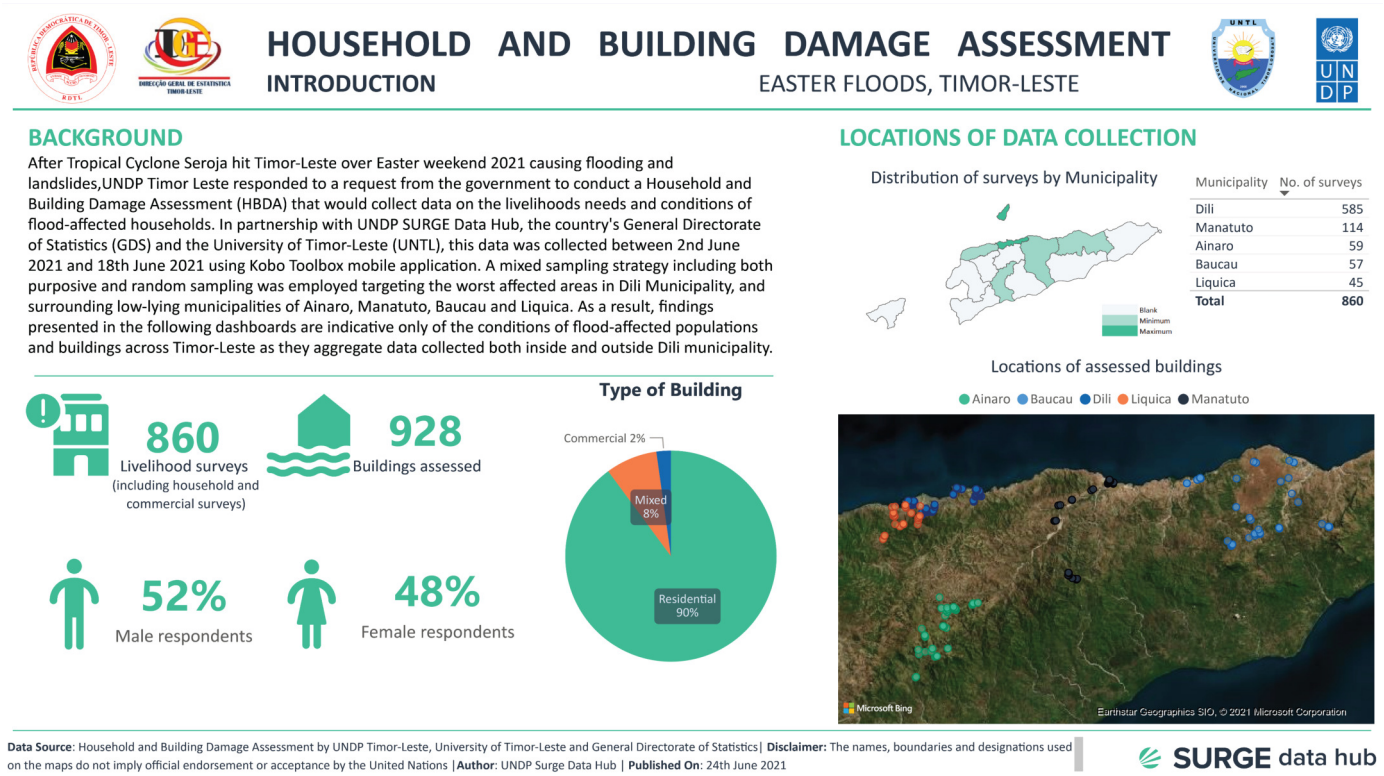
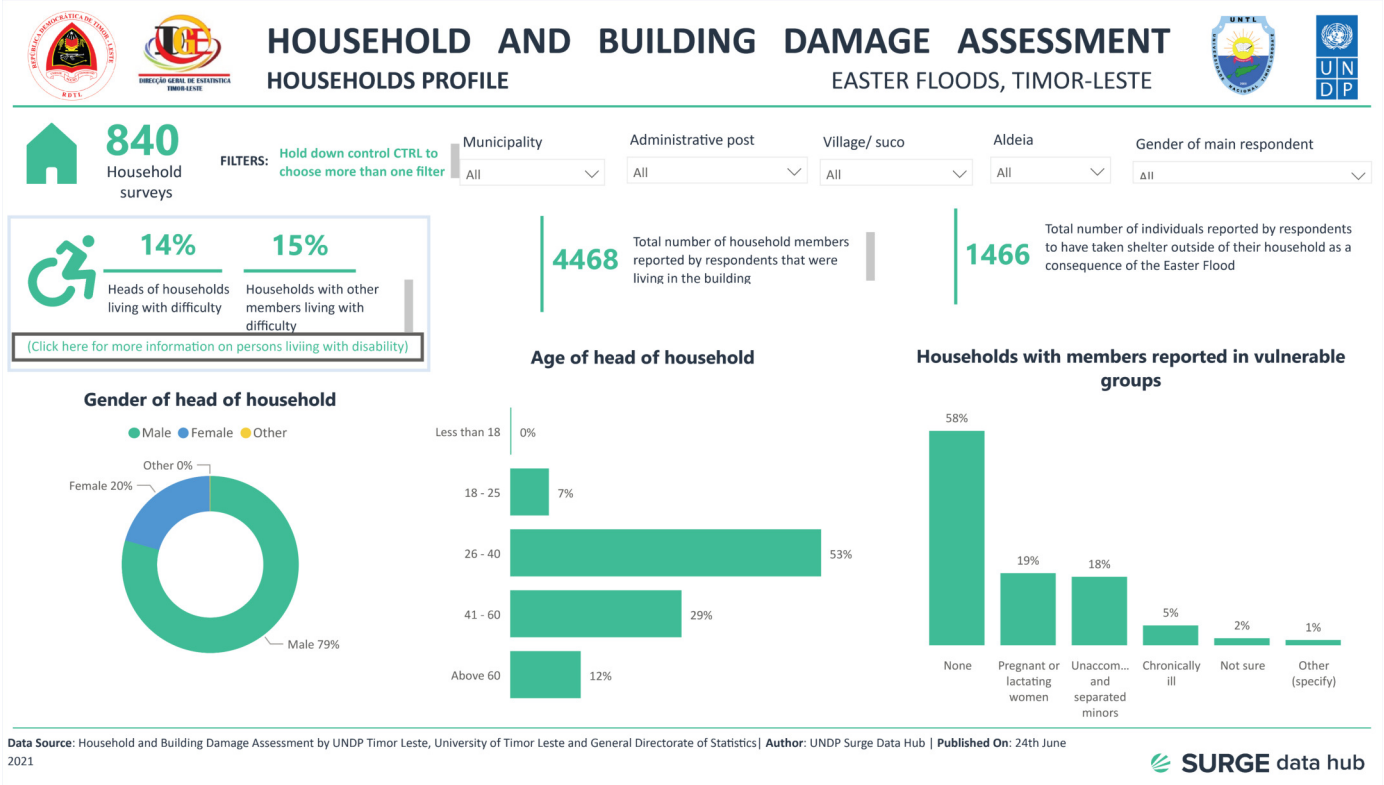
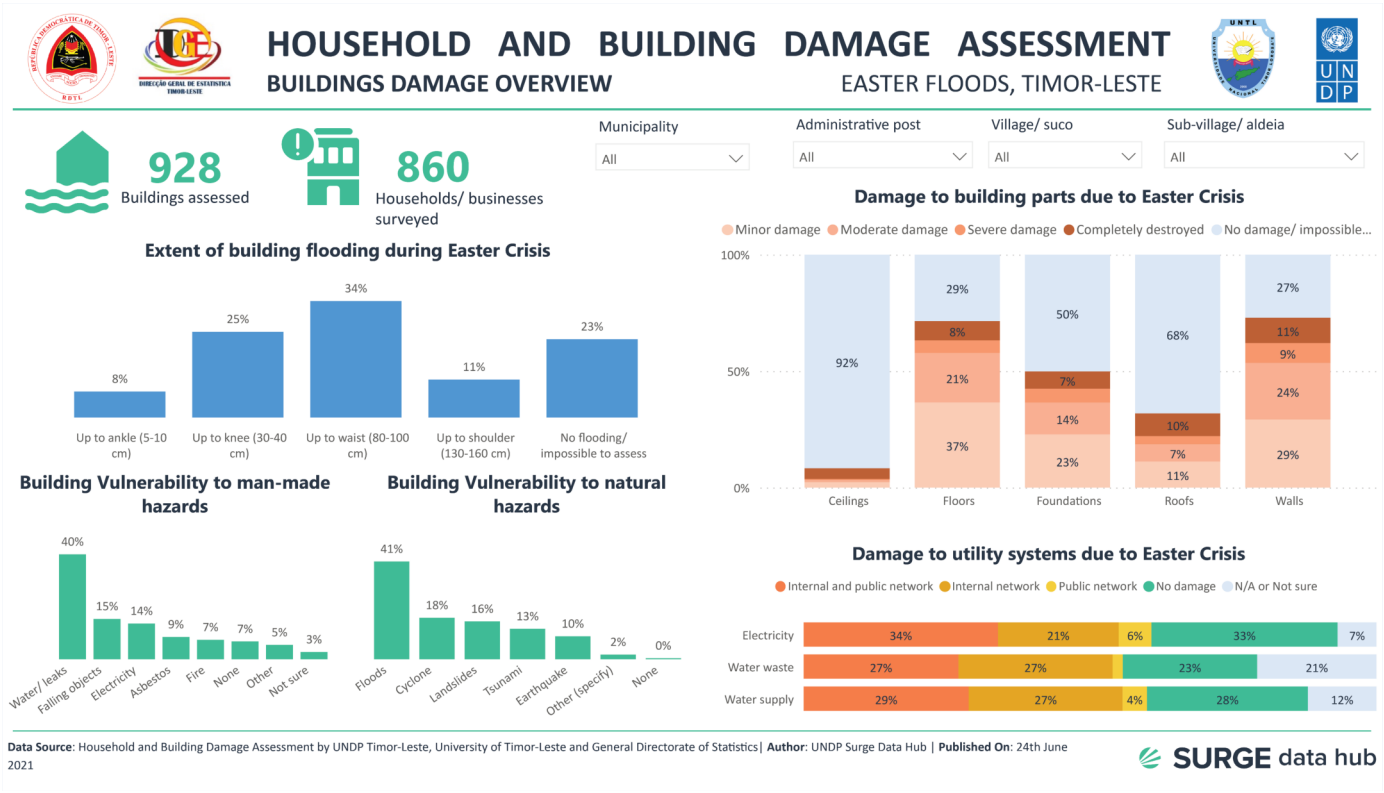
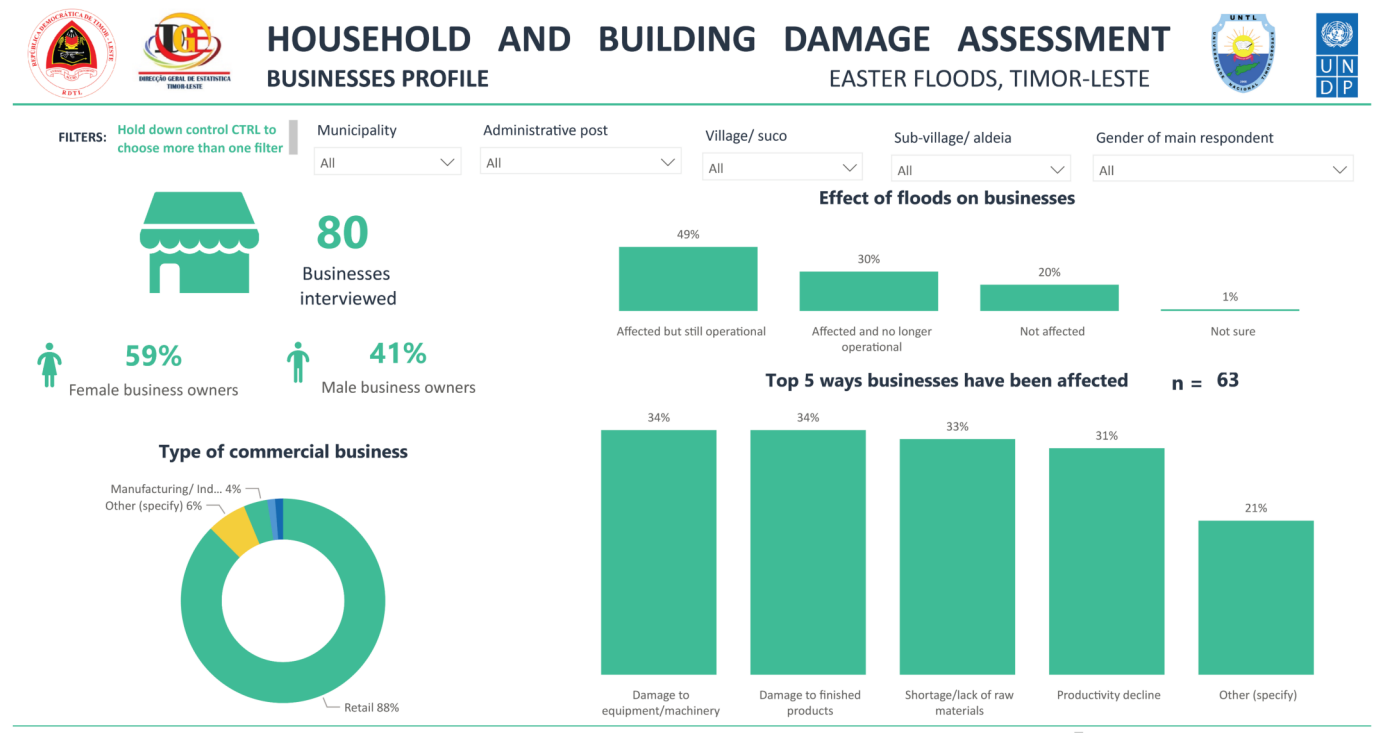
ANNEX

https://bit.ly/3F0px3Z






HOUSEHOLD AND BUILDING DAMAGE ASSESSMENT
BUILDINGS DAMAGE OVERVIEW
EASTER FLOODS, TIMOR-LESTE
928
Buildings assessed
860
Households/ businesses surveyed
Municipality
All
Administrative post
All
Village/ suco
All
Sub-village/ aldeia
All
Extent of building flooding during Easter Crisis
8%
25%
34%
11%
23%
Up to ankle (5-10 cm)
Up to knee (30-40 cm)
Up to waist (80-100 cm)
Up to shoulder (130-160 cm)
No flooding/ impossible to assess
Damage to building parts due to Easter Crisis
Minor damage
Moderate damage
Severe damage
Completely destroyed
No damage/ impossible...
100%
50%
0%
92%
29%
8%
21%
37%
50%
7%
14%
23%
68%
10%
7%
11%
27%
11%
9%
24%
29%
Ceilings
Floors
Foundations
Roofs
Walls
Building Vulnerability to man-made hazards
40%
15%
14%
9%
7%
7%
5%
3%
Water/ leaks
Falling objects
Electricity
Asbestos
Fire
None
Other
Not sure
Building Vulnerability to natural hazards
41%
18%
16%
13%
10%
2%
0%
Floods
Cyclone
Landslides
Tsunami
Earthquake
Other (specify)
None
Damage to utility systems due to Easter Crisis
Internal and public network
Internal network
Public network
No damage
N/A or Not sure
Electricity
34%
21%
6%
33%
7%
Water waste
27%
27%
23%
21%
Water supply
29%
27%
4%
28%
12%
Data Source: Household and Building Damage Assessment by UNDP Timor-Leste, University of Timor-Leste and General Directorate of Statistics| Author: UNDP Surge Data Hub | Published On: 24th June 2021
SURGE data hub


HOUSEHOLD AND BUILDING DAMAGE ASSESSMENT
BUSINESSES PROFILE
EASTER FLOODS, TIMOR-LESTE
FILTERS:
Hold down control CTRL to choose more than one filter
Municipality
All
Administrative post
All
Village/ suco
All
Sub-village/ aldeia
All
Gender of main respondent
All
80
Businesses interviewed
59%
Female business owners
41%
Male business owners
Effect of floods on businesses
49%
30%
20%
1%
Affected but still operational
Affected and no longer operational
Not affected
Not sure
Top 5 ways businesses have been affected
n = 63
34%
34%
33%
31%
21%
Damage to equipment/machinery
Damage to finished products
Shortage/lack of raw materials
Productivity decline
Other (specify)
Type of commercial business
Manufacturing/ Ind... 4%
Other (specify) 6%
Retail 88%
Data Source: Household and Building Damage Assessment by UNDP Timor-Leste, University of Timor-Leste and General Directorate of Statistics|Author: UNDP Surge Data Hub | Published On: 24th June 2021
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HOUSEHOLD AND BUILDING DAMAGE ASSESSMENT

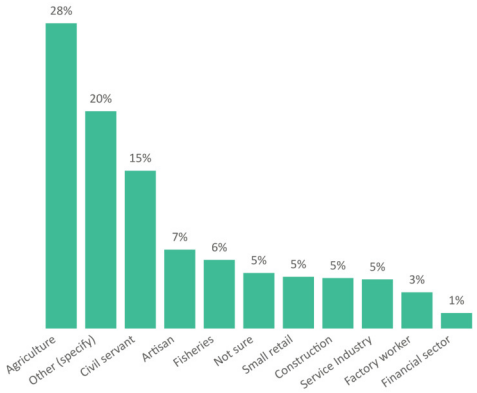
EMPLOYMENT AND INCOME

EASTER FLOODS, TIMOR-LESTE

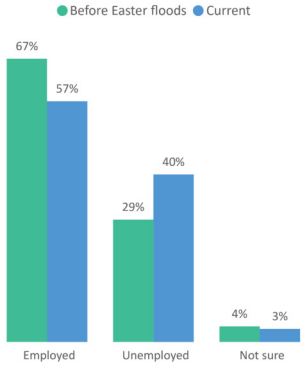
840
Household surveys

Municipality: All | Administrative post: All | Village/ suco: All | Sub-village/ aldeia: All | Gender of main respondent: All

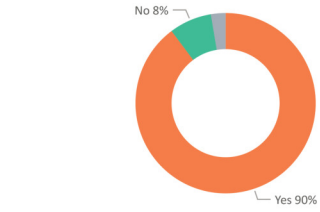
Main sector of employment for the main income earner(s) of the household



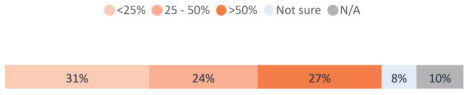
Main employment status of main income earner just before the Easter floods and currently



Households with a decline in income due to Easter floods



Decline in household income



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HOUSEHOLD AND BUILDING DAMAGE ASSESSMENT

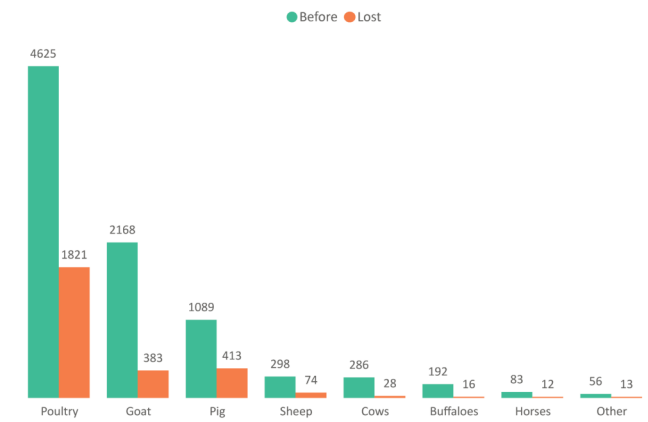
IMPACT OF FLOODING ON LIVELIHOODS

EASTER FLOODS, TIMOR-LESTE

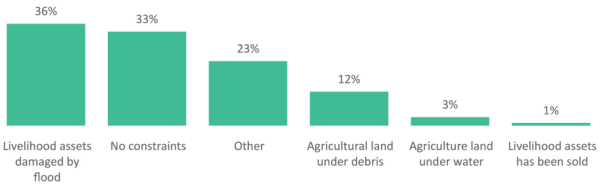
840
Household surveys

Municipality: All | Administrative post: All | Village/ suco: All | Sub-village/ aldeia: All | Gender of head of househ...: All | Gender of main respondent: All

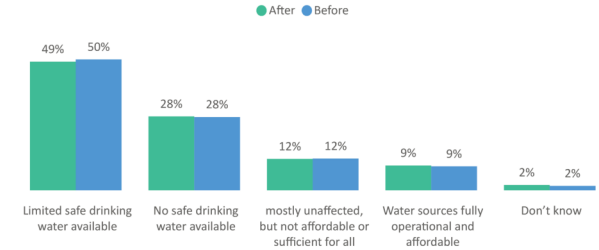
Livestock owned before and lost due to the Easter floods



Main constraints to restarting livelihood activities



Access to safe and affordable water before and after the Easter floods



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HOUSEHOLD AND BUILDING DAMAGE ASSESSMENT

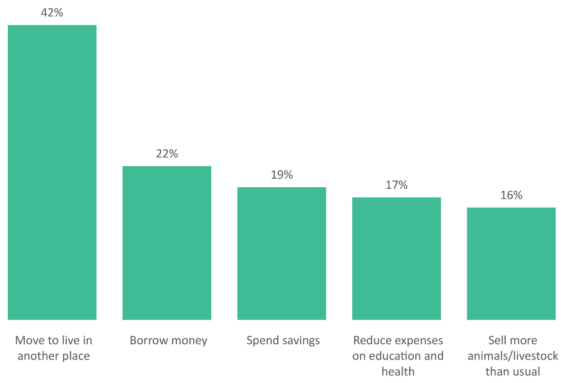
COPING STRATEGIES

EASTER FLOODS, TIMOR-LESTE

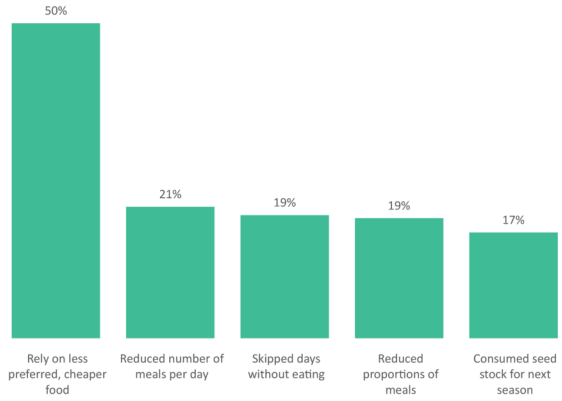
840
Household surveys

Type of Building: All | Municipality: All | Administrative post: All | Village/ suco: All | Sub-village/ aldeia: All

Top 5 measures taken due to lack of food or money to buy food during May 2021



Top 5 measures to compensate for a loss or potential loss of income



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HOUSEHOLD AND BUILDING DAMAGE ASSESSMENT

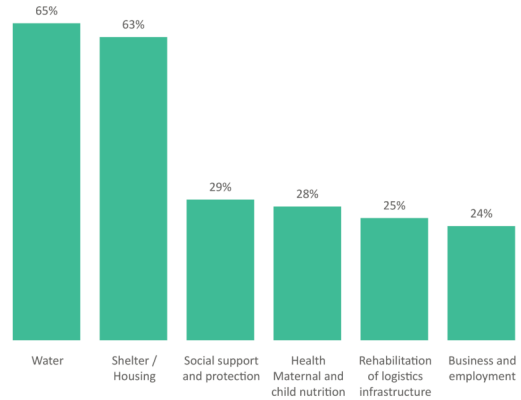
RECOVERY NEEDS

EASTER FLOODS, TIMOR-LESTE

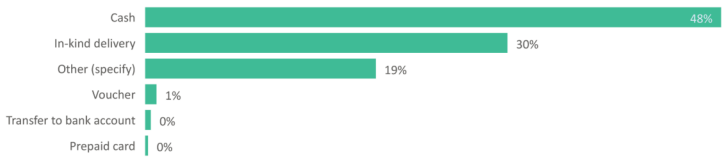
840
Household surveys

Type of Building: All | Municipality: All | Administrative post: All | Village/ suco: All | Sub-village/ aldeia: All

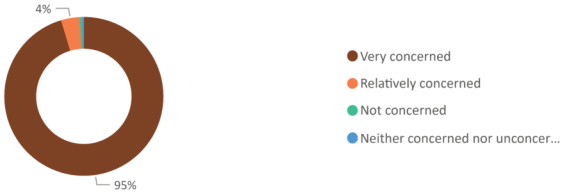
Households' top priority needs as a result of the Easter floods



Prefered delivery mechanism by respondents to receive assistance



Respondents overall concern over their households' livelihood conditions for the upcoming months



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