CLIMATE CHANGE & MARKETS FOR CHANGE PROGRAMMES

BUILDING MARKET RESILIENCE TO CLIMATE CHANGE

VANUATU ASSESSMENT REPORT

DECEMBER 2016

Australian Aid

MARKETS 4 CHANGE

UN WOMEN

UN Women's Markets for Change project

UN Women's Markets for Change project is a key component of its Women's Economic Empowerment programme. The six-year, multi-country initiative aims to ensure that marketplaces in rural and urban areas in Fiji, Solomon Islands and Vanuatu are safe, inclusive and non-discriminatory, promoting gender equality and women's empowerment. The United Nations Development Programme is the responsible party for outcome two of the project.

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UN Women is the UN organisation dedicated to gender equality and the empowerment of women. A global champion for women and girls, UN Women was established to accelerate progress on meeting their needs worldwide. UN Women supports UN Member States as they set global standards for achieving gender equality, and works with governments and civil society to design laws, policies, programmes and services needed to implement these standards. It stands behind women's equal participation; ending violence against women; engaging women in all aspects of peace and security processes; enhancing women's economic empowerment and; making gender central to national development planning and budgeting. UN Women also coordinates and promotes the UN system's work in advancing gender equality. The views expressed in this publication are those of the author(s) and do not necessarily represent the views of UN Women, the United Nations or any of its affiliated organizations.

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Executive Summary

As the #1 ranked country for vulnerability on the World Risk Index, the lives of men and women in Vanuatu are constantly threatened by climate change and disasters. Following the most devastating cyclone to ever hit Vanuatu – cyclone Pam in 2015 – and widespread drought as a result of a strong El Nino event throughout 2015 and most of 2016, the impacts are growing ever more severe with climate change predicted to increase the intensity and impacts of such events over time. This research assesses the extent to which the eight markets that UN Women supports through its Markets for Change (M4C) programme on Efate and Santo Islands are vulnerable to climate change.

The study set out to map, document and understand the relative vulnerability of these municipal markets and their vendors, farmers and wider communities to climate change risks. The outcomes are practical measures and policy recommendations that can be implemented by the M4C project, municipalities and other relevant stakeholders to reduce this vulnerability and to prepare for disasters.

The study used a combination of tools and processes to collect data including GIS mapping, on-the-ground assessment, interviews and participatory rural appraisal tools: namely a seasonal calendar, historical timeline and vulnerability matrix. It was successful in clearly identifying areas of vulnerability within the marketplaces themselves and their supply and governance systems; and clear similarities and differences between the market locations.

While each market exhibited different levels of exposure to different hazards, most markets are located on low-lying or reclaimed land very close to coast and waterways and therefore are at risk to storm surge, sea level rise, king tides and flooding. The findings showed all markets to be poorly prepared and inadequately resourced for a disaster and uncovered a clear need for general maintenance, infrastructure upgrades, climate change adaptation and disaster planning. Other factors which contribute towards high vulnerability of these markets to climate change include reliance on agriculture with very basic land and crop management techniques in use, low water and energy security, land accessibility disputes and poor management/lack of transparency with regard to use of financial resources. Women were seen to suffer additional challenges due to their responsibilities within the home and caring for children. Given Vanuatu's long history of disasters, local and traditional adaptive capacity can be said to be relatively high, despite the lack of knowledge, lack of access to technology and low literacy rates observed.

The recommendations made are not simply for the purpose of future climate change adaptation but are 'no regrets' strategies that will benefit Vanuatu market vendors, women and communities regardless of the extent of future climate change. They will be implemented in a progressive fashion along with a disaster preparedness plan that is to be developed at each market as a priority. The study has been repeated at M4C markets in Fiji and Solomon Islands.

1. Introduction

Climate change is one of the most urgent issues affecting Pacific Island countries, which have always been particularly vulnerable to disasters. The effects of climate change in the Pacific region include increased frequency and intensity of extreme weather events, rising sea levels and coastal erosion, water salinisation and coral bleaching (Keener et al., 2012). This will of course have a significant impact on the lives of Pacific Island women in terms of food and water security, financial security and the sustainability of natural resources.

Climate change is exacerbating the consequences of disasters in the Pacific, eroding the resilience of communities, creating challenges for long-term sustainable development and worsening inequalities. Adequately addressing the risk of climate change and disasters requires assessing and responding to the needs of various groups within communities. Women, more than men, are particularly vulnerable to the effects of climate change for a range of social, economic and political reasons; including unequal access to resources and to decision-making processes that limits their coping capacity, necessary for responding and adapting to climate change. Their gender-related responsibilities in securing food and water and also their high dependence on natural resources further exposes them to climatic impacts. However, women also have essential skills and knowledge necessary for effective adaptation and response (Commission on the Status of Women, 2008). To address these challenges, UN Women is working to strengthen gender equality and women's empowerment through climate change policy and practice as well as through women's economic empowerment, with a particular focus on marketplaces.

Between 75 and 90% of market vendors in the Pacific region are women (UN Women National Committee Australia, 2016). These women experience long hours, low profits and difficult conditions. Women often come from rural areas and sleep at the market for three to four days, exposed to high risks of violence and theft. Markets for Change (M4C) is a UN Women project operating in Fiji, Solomon Islands and Vanuatu. Given that the majority of market vendors are women, and that many more women rely on the market for food supply, the project's goal is to ensure that marketplaces are safe, inclusive and non-discriminatory with country-specific implementation based on local circumstances. The project has four focus areas:

1. Increase voice and participation of market vendors through accessible, inclusive, and representative governance structures that enable markets to grow and strengthen the role and influence of women.
2. Improve socio-economic security through assessing and responding to the financial and business needs and interest of market vendors and rural producers.
3. Ensure decision-making processes are transparent, accountable and responsive to the need of vendors through gender-responsive local governance and market management.
4. Improve physical infrastructure and operating systems to make markets more sustainable, resilient to disaster risks and climate change, safer and more accessible.

Rationale

Food security is becoming a priority throughout the world, and governments can no longer afford to ignore the important roles played by market traders in bringing affordable, nutritious and high quality produce to towns and cities. This is particularly true in the Pacific Islands. An economic analysis of select markets in Fiji found markets to be critical sites of social, cultural and economic activities that make significant

contributions to the local and national economy (Barnett, 2010). Income from market trading is redistributed in the community through fees paid to city and town councils, and by women market traders spending their earnings on education, food, and shelter for their families (Foundation for Development Corporation, 2010). The importance of markets to the livelihoods of women in and across the Pacific is well recognised by the M4C project. The risk that climate change and disasters present to market operation, and income and food security for these women has been highlighted by recent events such as the 2012 Fiji floods, 2014 Solomon Islands floods, Tropical Cyclone Pam in 2015, the 2015/16 El Niño southern oscillation and most recently Tropical Cyclone Winston in Fiji in 2016.

Vulnerability assessment is a key instrument to identify and prepare for climate change and disaster risks. It provides information for decision-makers on the extent and magnitude of likely impacts attributable to climate change, as well as suggested policies, improvements and preparation to prevent or reduce the severity of these impacts and enhance resilience.

Outline

This report summarises the findings of the second phase of an assessment of the vulnerability of local markets which will be undertaken in the Solomon Islands, Fiji and Vanuatu. It studies the M4C markets in Vanuatu: Port Vila and Marobe market on Efate Island, Luganville market on Santo Island, and two of the five smaller Efate Island ring road markets. The report presents current and future climate change experienced here, an assessment of relative vulnerability and resilience based on the locations and current state of the markets themselves; knowledge, practices and awareness of market staff, vendors, farmers and communities; and presents short and long term recommendations to increase resilience. Finally, UN Women has worked alongside the national and provincial disaster management offices (PDMOs) to develop disaster management plans for the markets. Disaster and climate change risk assessment and preparations are considered necessary not just for ongoing sustainability of the markets but also for communities as a whole.

The findings of this report will inform decisions for market improvements and add a new disaster preparedness component to the M4C project so as to enable market vendors and their communities to be more resilient, better prepared for disasters and better able to maintain or recover their livelihoods following future disasters. The study supports the purpose of the Vanuatu Climate Change and Disaster Risk Reduction Policy 2016-2020: *'Vanuatu is a resilient community, environment and economy.'*

Study Purpose

Limited information is available regarding the resilience of market structures and amenities, supply chains, market vendors and farmers and their livelihoods against climate change and disaster risks. Such information is necessary for understanding the complex actual and potential impacts of climate change on markets' systems. It is essential to inform the identification and design of effective strategies that can make markets and market vendors more resilient to future climate change. The purpose of this research is as follows:

- To raise awareness of climate change risks within the community and local government and market staff.

- To identify particularly vulnerable people, crops, time periods, locations and countries in relation to market operations.

- To identify effective strategies to increase resilience to climate change including adaptation and disaster management planning and allocation of funding to particularly vulnerable groups and activities.

- To collect baseline information to monitor the performance of climate change adaptation policy and interventions

Scope

The scope of this project is to study the relative vulnerability of all of the marketplaces that make up UN Women's Markets for Change project, as part of the Women's Economic Empowerment programme. There are twelve markets in Fiji, two markets in Solomon Islands and three major markets and five small roadside markets in Vanuatu. This report concerns the three main and two subsidiary Vanuatu markets (Figure 1).

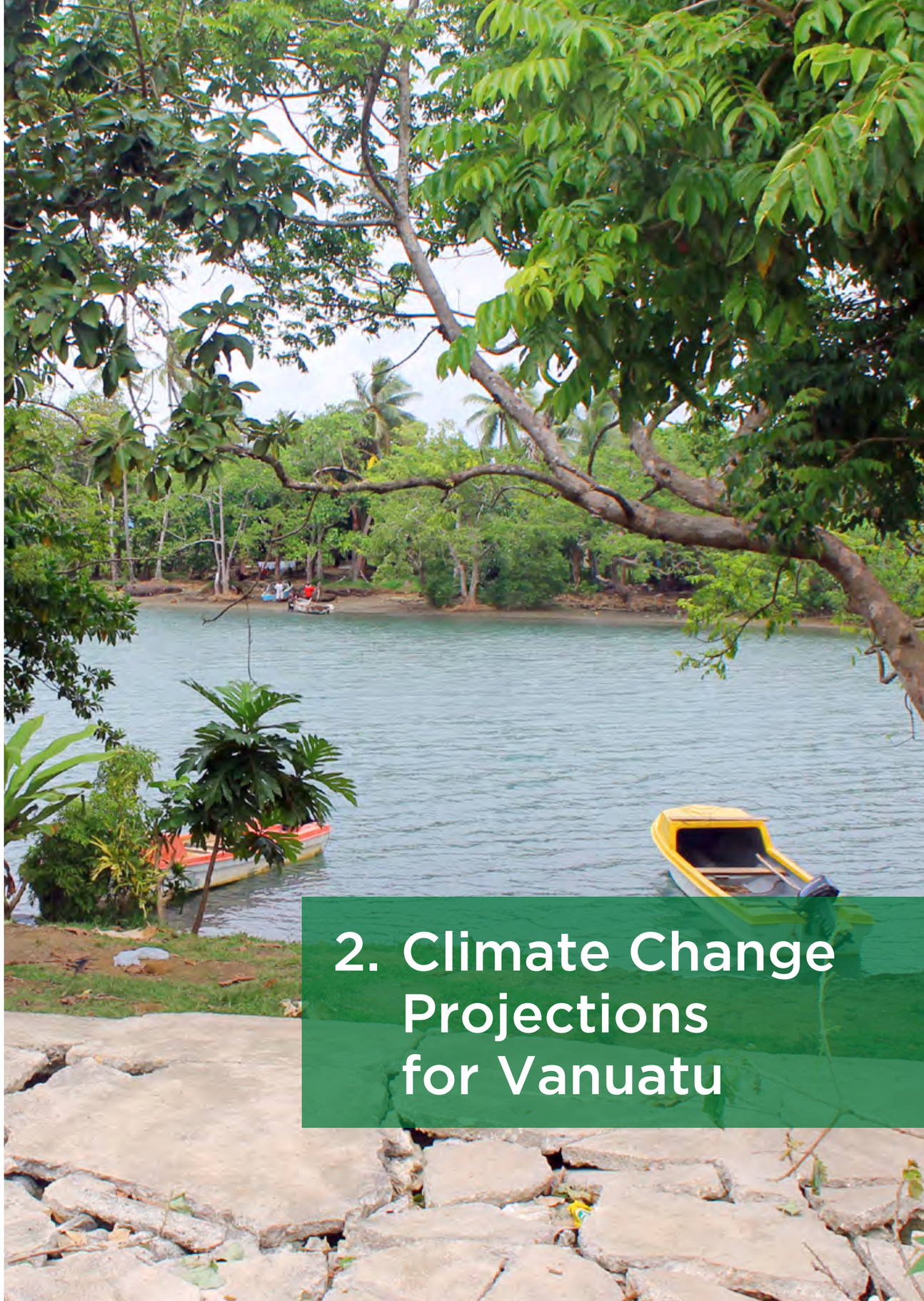
Objectives

There are three stated objectives:

1. To map, document and understand the vulnerability and relative resilience of Vanuatu's Markets for Change markets, their vendors and farmers to climate change and disaster risks.
2. To identify practical measures and policy recommendations that can be implemented by the M4C project, municipalities and other relevant stakeholders to reduce the vulnerability of the assessed factors to future climate and disaster risks and to prepare for disasters.

3. To assist the development of disaster risk management plans for the markets and support information dissemination on disaster preparedness and response in partnership with other organisations.

Figure 1: Vanuatu market locations



2. Climate Change Projections for Vanuatu

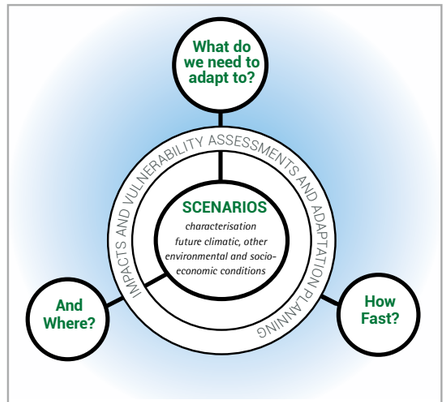


Figure 2: Vulnerability assessments and adaptation planning help gather knowledge and develop scenarios for informed decisions to be made to protect against the impacts of future climate change (source: UNFCCC, 2011)

The Solomon Islands, Vanuatu and Fiji are all heavily impacted by disasters, many of which are exacerbated by climate change. Those living here depend heavily on agriculture which can be wiped out by a cyclone, flood, or drought. As Figure 2 shows, this section will use knowledge of the impacts of past disasters and predicted climate changes in Vanuatu to characterise future conditions. Knowledge of future conditions will enable the vulnerability assessment and adaptation planning objectives of this study. Together with fieldwork, the scenarios developed from this desk-based research will enable the prioritisation of certain risks, locations and scenarios, and thereby inform future decisions for the protection of housing, marketplaces, infrastructure and agriculture against climate change to improve the resilience of market vendors' livelihoods.

Current climate

Changes in Vanuatu's temperature from season to season are strongly tied to changes in the surrounding ocean temperature. The country experiences a warm wet season from November to April and a cooler dry season from May to October. Rainfall in Vanuatu is affected by the South Pacific Convergence Zone, the band of heavy rainfall caused by air rising over warm waters where winds converge, resulting in thunderstorm activity. Low pressure systems in this band often become tropical cyclones during the cyclone season. During the wet season, rainfall is particularly high on the windward side of the mountain ranges of the bigger islands and scarce on the leeward sides. Vanuatu's climate also varies considerably from year to year due to the El Niño-Southern Oscillation. El Niño years bring drier conditions, a late start to the wet season and cooler than normal dry seasons. The opposite occurs during La Niña (Vanuatu Meteorology and Geo-Hazard Department, 2011).

Impacts to Date

CYCLONE PAM March 2015

The worst recorded cyclone struck Vanuatu in March 2015 with wind speeds of 250 km/h and gusts of 320 km/h. The centre of the cyclone passed east of Efate Island and west of Eromango Island and Tanna Island (Fig. 3). Cyclone Pam severed all modes of transportation, hampering access to markets in Port Vila and other centres, and access to education and health facilities. Rain caused flooding and damage to culvert crossings, road pavements and aerodromes.

Figure 3: Category 5 tropical cyclone Pam strikes Vanuatu, March 2015

Only 30% of the population was left with access to electricity, 16,000 houses were damaged and the livelihoods of about 40,800 households, or 195,000 people, across four provinces were affected (Government of Vanuatu, 2015).

The cyclone was slow moving and dry, therefore wind damage to houses was extensive; but water damage reduced. Damage was worst in areas of traditional housing constructed from local materials. Therefore Efate Island was less impacted than less developed islands with less resilient building types, and rural communities were more impacted than urban ones.

80% of Vanuatu's population relies on crops, livestock, and fisheries for livelihood and food and nutrition, and at least 70% of the rural population derives income from agricultural activities, usually through the markets. Given Vanuatu's strong dependence on agriculture for subsistence work, smallholder households were gravely affected: half of all agricultural households located in disaster-affected provinces lost the entirety or parts of their crops such as kava, copra, and cocoa that take up to one year to reestablish. Both seasonal crops (vegetables) and annual crops (cassava, taro) were also lost. Many rural households found it difficult to access markets for cash crops, particularly in the most remote areas (Government of Vanuatu, 2015).

CYCLONE ZENA April 2016

Tropical Cyclone Zena largely bypassed Efate, taking the island of Santo by surprise as there was little advance warning from the capital. It brought winds of 70 to 90 km/h and rain lasting about two hours, causing power cuts, destruction of garden crops, minor damage to houses and flooding in Luganville town. In Luganville and East Santo many trees, including coconut trees, were uprooted. People from south Santo were not able to travel to Luganville for supplies or income due to rivers bursting their banks (Radio New Zealand, 2016; Vanuatu Post, 2016).

CYCLONE UMA February 1986

Until cyclone Pam, Uma was the worst cyclone in Vanuatu's history. It is estimated that 48,000 people (34% of the population) were directly affected, and 48 died (Government of Vanuatu, 1987). In the aftermath, Port Vila was declared a disaster area without water, electricity or communications services and with heavy damage to buildings and houses. Many government offices were damaged and closed for days. Evacuation centres were established for some 5,000 made homeless and outlying villages were cut off for many days. It was estimated that 95% of houses were destroyed or damaged (UNOCHA, 1987) and Efate's smallholder farms were destroyed causing food shortage until July-Sept and cash shortages over 2-3 years due to lost coconut palms. To cope, farmers on Efate switched to alternative income earning opportunities where available (Govt. of Vanuatu 1987).

EL NINO 2015-2016

Unfortunately, the areas worst hit by cyclone Pam suffered the most under the impact of El Niño-induced drought in 2015/16. Approximately 40% of households ran out of water within 14 days of the cyclone and one fifth of households had to travel more than 30 minutes to collect drinking water. This is generally the responsibility of women. Many Vanuatu communities do not maximise their rainwater capture potential, a major contributor to drought vulnerability, and a very large portion of rainwater harvesting structures were damaged in Cyclone Pam. Crops damaged in Cyclone Pam did not regrow because of the lack of rain. Approximately 90% of all agricultural crops, livestock, fisheries, forest trees and water resources were adversely affected by El Niño-related heat stress, soil moisture deficits, root rot, leaf blight and pest infections. Most communities experienced shortages of food and water for 2-3 months (UN OCHA, 2016).

Future Projections

By 2030, temperature is projected to rise 0.4-1.0°C. There will be an increase in the number of hot days and warm nights and a decline in cooler weather. Rainfall is predicted to progressively decrease in the dry season and increase in the wet season. Extreme rainfall will become more common. Rising sea level will increase the impact of storm surges and coastal flooding. Ocean acidification will continue to reduce the health of reef ecosystems. There is likely to be a decrease in number of tropical cyclones and an increase in their intensity will result in more damages that will take much longer to repair. Under this scenario, damage to transport routes will mean that farmers cannot access markets in Port Vila for long periods of time as well as educational and health facilities, and even the more durably built houses will be damaged along with traditional housing. Households that depend solely on their crops for their livelihoods are particularly vulnerable, and face regular loss of their crops that take months to reestablish. (Vanuatu Meteorology and Geo-Hazard Department, 2011).

3. Methodology

Vulnerability: ***'the degree to which a system is susceptible to and unable to cope with adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate change and variation to which a system is exposed, the sensitivity and adaptive capacity of that system' (UNFCCC, 2011).***

The key factors contributing to climate change vulnerability, the subject of this study, are exposure, sensitivity and adaptive capacity. Their relationship is illustrated in Figure 4 and they are defined as follows:

- **Exposure:** 'the nature and degree to which a system experiences significant climatic variations'.
- **Sensitivity:** 'the degree to which a system is affected, either adversely or beneficially, by climate-related stimuli. The effect may be direct (e.g., a change in crop yield in response to a change in the mean, range, or variability of temperature) or indirect (e.g., erosion and damage caused by an increase in the frequency of coastal flooding due to sea-level rise)'.
- **Adaptive capacity:** 'the ability of a system to adjust to climate change - including climate variability and extremes - to moderate potential damages, to take advantage of opportunities, or to cope with the consequences' (McCarthy, et al., 2001). Characterising adaptive capacity uses the attributes, mechanisms, or indicators of social-ecological systems that play a role in facilitating adaptation as outlined by Ellis (2000); Smit and Pilifosova (2001); Brooks et al. (2005); Smit and Wandel (2006) and Nelitz et al., (2013).

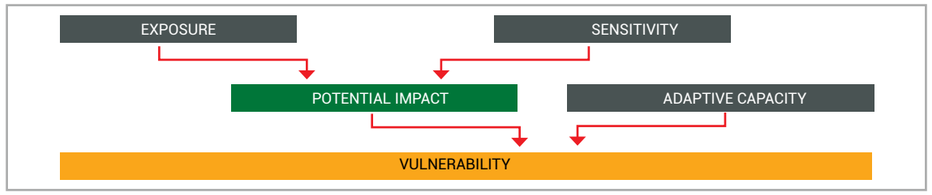


Figure 4: Factors for assessing climate change vulnerability (Source: UNFCCC, 2011; adapted from Allen Consulting, 2005)

Methodological Considerations:

The methodology employed for this project is largely based on UNFCCC guidelines and the Nairobi Work Programme of Action (Table 1). It takes a 'vulnerability and adaptation' approach, and is mostly bottom-up, with input from climate data analysis and GIS data analysis (UNFCCC, 2011). Vulnerability assessments are commonly distinguished as either following top-down or bottom-up approaches (Dessai & Hulme, 2004). Top-down approaches focus on an analysis of climate change and its impacts, while bottom-up approaches analysis the people affected by climate change (van Aalst et al., 2008). Both analyses were necessary in this case, but the overall methodology design is largely bottom-up, which is more suited to local level analysis. Bottom-up approaches generally do not rely on model-generated climate data, but involve collecting information from the specific location (Hinkel, et al., 2010; Wolf, et al., 2013). Bottom-up vulnerability assessment uses tools such as Participatory Rural Appraisal (PRA) tools used here to reflect many different voices, perceptions and experiences. The synthesis of the results and identification of priorities for action is critical in this approach (Hinkel et al., 2010).

Table 1: Good practice and lessons learned in assessing climate change impacts and vulnerability (Source: UNFCCC, 2011)

Scope	Upfront efforts to engage all relevant stakeholders, analyse the natural and social contexts, and determine the focus and expected outputs of the assessment will prove time well spent.
Selection of methods and tools	The selection of assessment approaches, methods and tools needs to be guided by the purpose of the assessment, the availability of resources and time, as well as pragmatism.
Qualitative as well as quantitative	Both qualitative and quantitative analyses are helpful. This is particularly important when traditional knowledge and inputs from indigenous communities are incorporated into the assessment process.
Present versus future	Detailed analysis on current trends in climatic patterns, socio-economic trends and adaptation responses could provide many insights into how changes in the future may affect the natural and social systems, and which adaptation options may help to reduce vulnerability. This is particularly important to bear in mind if analyses on future impacts and vulnerability are impeded by uncertainties associated with, among others, climatic and socio-economic scenarios.
Stakeholders	Key stakeholders need to be involved throughout the entire assessment process - they can provide important inputs to the assessment process, as well as validate the interim results.
Collaboration	Inputs from a wide range of disciplines (e.g. natural science, social science, engineering, economics) are often required. Effective collaboration among experts and stakeholders from different disciplines/sectors are important to ensure the credibility of the assessment results.
Transparency	For the results of assessments to be effectively and appropriately used in adaptation decision planning, it is important to be transparent about the underlying assumption and caveats of the assessment process and its results.

There are many bottom-up methods and tools available. A successful case study from West Bengal (GIZ, 2014) followed the general approach outlined below (Fig. 5). A similar methodology has been used for this research.

1. Assessment of topography through GIS
2. Field trip for ground survey (and photos)
3. Discussion with local people (through interviews and focus groups)
4. Synthesis of findings and recommendations

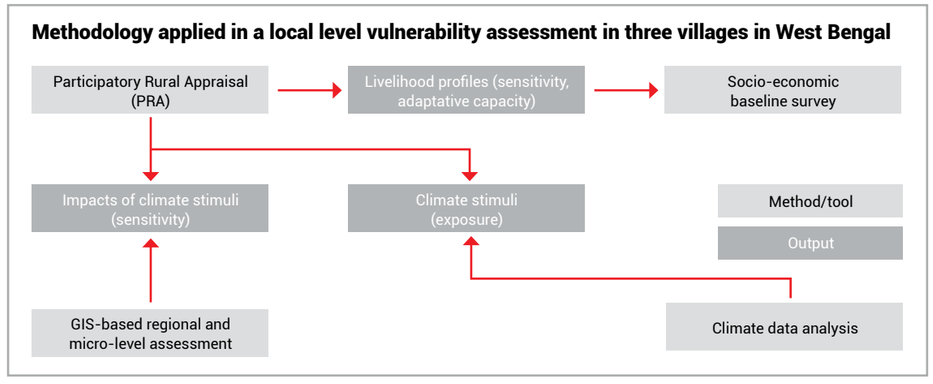


Figure 5: Methodology applied in a local-level vulnerability assessment in three villages in West Bengal

Method Outline

1. Desktop Research:

Background research formed a critical element of the study, and was undertaken to inform the design of the rest of the methodology, to map locations in regards to risk and to gain an in-depth understanding of the context of climate change in Vanuatu. Firstly, recent literature was reviewed to develop the vulnerability assessment framework in order that fieldwork adequately assess exposure, sensitivity and adaptive capacity within the market context. Secondly, risk maps of Vanuatu from NDMO were examined to assess the locations of the markets in relation to risk factors (coast, waterways and flood plain, wind zone, tsunami zone). Finally, documented impacts of historical climate events and disasters (where available), and the projected climate changes were reviewed to outline future projections of climate change impacts (social, environmental and economic) at the market locations.

Figure 6: Market vendor focus groups in action: Luganville

2. Field work:

Field work was undertaken over two weeks in the five selected market locations, with stakeholder meetings with local council, disaster management officers and market management at open and close of the work. These meetings were critical to verify the findings of the desktop research (above) and to more deeply explore the factors influencing vulnerability at the local community level.

The research activity comprised an assessment of market physical infrastructure, existing facilities and management structure. Current market conditions - including structures, access routes, facilities and ablutions, waste disposal and drainage - were assessed using the checklist supplied in Appendix 1. The second activity was comprehensive focus group discussion with 12-16 market vendors to identify key vulnerability factors, issues and priority actions, and to assess the ability of market vendors to adapt to climate change within their daily lives (Fig. 6). Focus group discussions were also attended by the Market Manager, Market Vendor Association (MVA) president and PDMO. The 12-16 people were divided into mixed groups of 4-5 based on geographic factors, and three PRA tools were used by each group (CARE, 2009): a seasonal calendar to identify high-risk times of year; a historical timeline to describe historical sources of risk and events that have the most impact, and a vulnerability matrix to illustrate the most vulnerable and resilient resources, and the biggest hazards with respect to their impact on livelihoods.

During the focus groups, 4-6 individuals were identified for a short, one-on-one semi-structured interview (refer Appendix 2 for structure). The majority of whom were women, as they make up the majority of market vendors and are often reliant on market income to support their families. The purpose of the interviews was a more in-depth analysis of personal experiences of climate change and disaster and fears, concerns, knowledge and awareness of the vendors themselves (Fig. 7).

Figure 7: Interviews with market vendors underway in Emua

3. Analysis:

As explained by Figure 2, vulnerability is a function of several factors: exposure (where something is), sensitivity (what is there and its condition), and adaptive capacity (the systems in place and the general adaptability of the systems in place and the community itself). Therefore, the final step in the vulnerability assessment process is to combine the findings about sensitivity and adaptability to determine how and where the market is vulnerable to climate change.

The information was synthesised to develop a single completed checklist, seasonal calendar, historical timeline and vulnerability matrix for each market. Along with the maps this information was analysed to draw conclusions in regards to risks and opportunities at each of the markets, to identify practical measures and policy recommendations that can be implemented by each of the stakeholders: the UN Women Markets for Change project, municipalities, market vendor association, PDMOs and market vendors themselves to reduce the vulnerability of markets and livelihoods to future climate and disaster risks and to prepare for disasters (Snover et al., 2007).

4. Disaster planning:

In the final stage of the project, disaster risk management plans will be developed for the markets and, along with supporting information, disseminated to the markets and their communities. Stakeholder meetings have identified a clear need for ownership and tailoring of these plans to take account of the inherent differences and develop a disaster response that is specific to that location.

4. Results: Port Vila Market

Market Assessment

Design and Construction:

Port Vila market sells a large range of fresh produce, handicrafts, cooked food and clothing. It is solidly constructed though was not spared from damage during cyclone Pam: it was closed for a month while clean up and repair was undertaken. It has an unusual design, inspired by a turtle. The design does not work well as there is an uncovered area in the middle of the market, open to the elements and there is no spouting. To minimise flooding during heavy rain and cyclone at Port Vila market, repairs and improvements to the roofing and unblocking of the drainage system, which is not jetted regularly, are essential. All main drains are blocked and the pump is broken.

Location:

The market is centrally located in Port Vila town. It has just a few metres setback from the sea (Fig. 8) where there is a very real tsunami risk and it is a fairly crowded space between the coast and the main road with private land on either side and therefore no room for expansion. It is supported by smaller satellite markets. Risk maps commissioned by the NDMO show that Port Vila market has very high tsunami risk with a >8.0m maximum inundation depth. Wind and river flood risk is relatively low therefore the combined potential risk overall is moderate (Fig. 9).

Figure 8: Layout and features of Port Vila marketplace. Source: Google

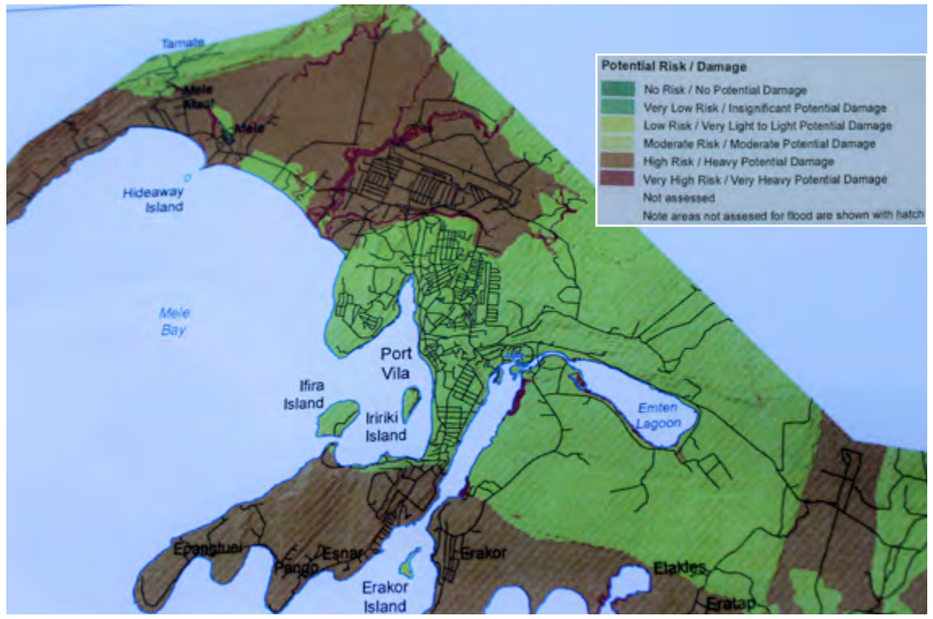


Figure 9: Combined overall risk map showing moderate risk for Port Vila, Marobe and high risk for Mele Maat communities. Source: NDMO

Governance and Maintenance:

The market manager has a budget for management, maintenance and improvements at the market, and a team of twelve people supporting him. The financial management system lacks transparency but, unlike other Markets for Change, the market manager directly receives the daily market fees from the vendors and is able to use this immediately for maintenance and costs as necessary and much more effectively, rather than passing funds directly to the municipality for redistribution. No disaster planning has been undertaken at Port Vila market to date.

Facilities and Services:

The market's source of energy and water is municipal. There is no secondary energy source; there is rainwater harvesting but this is not considered potable water. Security is a concern raised by both the market manager and vendors: respect for others' property is low, there is a low level of enforcement and no barriers or closing hours for the market. Petty crime levels are therefore high, particularly during the weekend. At the time of assessment a CCTV system was being installed.

Transport:

Port Vila is a hub for many outlying villages and small islands. Many of the market vendors travel long distances by road or sea to sell at the market. Because the route around Efate Island is a single road, crossing many bridges and rivers, in the case of a disaster, villages can be cut off from the marketplace, and therefore food supplies and income source for days or weeks. The market offers no accommodation or storage for the market vendors, which means that they cannot leave the market until all their produce is sold, even in a disaster, and must pay freight costs for unsold produce.

Table 2: PORT VILA MARKET ASSESSMENT

	Cyclone	Drought	Flooding	Tsunami	TOTAL
Main building	2	0	3	2	7
Associated infrastructure	2	0	1	2	5
Produce sold	3	3	2	2	**10**
Governance and finance	2	1	1	2	**6**
Waterways	2	0	3	2	7
Disaster planning	3	2	3	3	**11**
Energy security	1	1	1	1	4
Water security	2	3	2	2	9
Accessibility	2	0	3	1	6
Transport	3	0	2	2	**7**
Drainage	3	1	3	3	9
Waste management	2	1	2	2	**7**

Focus Groups

Focus group discussion formed the second part of the methodology. Objectives were to develop a seasonal calendar, historical timeline and vulnerability matrix for each market to assess vulnerability at different times of year; in different years and to different types of event. The first focus groups were undertaken with representatives from Port Vila, Marobe and Ring Road markets.

During the seasonal calendar exercise, all groups highlighted that seasonality is significant, with large differences between the dry and wet season affecting them greatly, and very little 'optimal' conditions in between. During the dry season they undertake activities such as building houses and harvesting seeds, but in some parts, water shortages are now experienced almost every dry season resulting in less excess food for sale at this time. During the wet season cyclone risk is a big concern, and cyclones tend to correspond with a vulnerable time of year when income is lower, some crops are poor, and holidays and school fees increase household costs. Some crops are available all year; others are very variable. For the vendors that must travel a distance to reach the market, flooding during this time can damage roads and bridges enough to cut them off from Port Vila for long periods. Paungagisu and Epau ring road markets have not yet been rebuilt since Cyclone Pam, so these communities are completely reliant on the road to Port Vila for selling at market when they have excess resources. Some from Mele Maat ring road market also travel to Port Vila, particularly at times when the tourist season influences sales, or to stock up on other products for resale at MeleMaat. Each year, and throughout the year, seasonal workers are lost to New Zealand and Australia, and therefore are unavailable to assist in the garden, but bring back money for their family. There are also a number of church and community events and responsibilities that are important throughout the year and of course influence time spent on economic activities.

During the historical timeline exercise, significant events identified were either weather-related: cyclones, times of extreme dry and wet; seismic: earthquake, tsunami and volcanic eruption; or human-induced: riots, land disputes. It was observed that dry seasons seem to be lengthening and wet seasons are no longer typical or reliable. Both of these conditions affect gardens so greatly that for some women, no marketing can take place.

The vulnerability matrices for the various groups reinforced the threat from cyclones, being the highest or second highest rated hazard by every group. A large range of hazards was identified, with flooding and fire also rated very highly. The market vendors rated their garden as their highest valued/most vulnerable resource, closely followed by the market and housing, all of which are often damaged by cyclone and flood in the wet season. Overall the vulnerability matrices showed that climate change is likely to increase the likelihood of many hazards and exacerbate all of the impacts currently experienced as a result of those, and other, hazards.

INTERVIEWS

The findings from interviews were analysed to assess relative exposure, sensitivity and adaptive capacity by different groups at each market/ group of markets. Together, these factors provide an indication of relative vulnerability.

EXPOSURE

Port Vila market and its vendors are exposed to a number of hazards. Most notably, the interviewees spoke of their concern of another direct hit by a tropical cyclone, so great were the impacts of cyclone Pam on food supply and market vending. It was unfortunate that a strong El Nino event and extended drought directly followed the cyclone, so where destroyed crops were able to be resown, most did not germinate or grew very poorly. The market was closed for repair following cyclone Pam, though some market vendors still sold there, or sold elsewhere along the roadside. There was urgent selling off of damaged goods immediately following the cyclone and then many months of limited food supply and high market prices. Port Vila market vendors and their livelihoods are also regularly affected by heavy rainfall events. Those that live in the more mountainous interior of Efate seem less exposed and more resilient to disasters due to a favourable microclimate, distance from the coast and fertile soil. The risk maps obtained from the NDMO show that the market location has a 'moderate' overall risk exposure and 'very high' exposure to tsunami.

SENSITIVITY

Some characteristics of the market contribute to its sensitivity. It is crowded and many market vendors must travel a long way and sleep in the market until all their produce is sold. They cannot offload remaining produce to local sellers and there is no storage facility available to them, adding the cost of return freight in cases where they must take it home. The marketplace needs better security as goods can be stolen at night, particularly over the weekend, despite there being a guard on patrol. To address this, CCTV has been installed and a perimeter fence is proposed. Better protection from the rain and/or improved sleeping quarters and a robust plan for disasters, well-known by vendors, would significantly reduce sensitivity to climate change.

The type of crops most commonly grown depends on location and soil type of the vendor's farm. There is a relatively small range of crop species which increases sensitivity, though the Ministry for Agriculture and the Farm Support Association are working to improve resources and farming practices. The most common on Efate are root crops such as taro, manioc, peanut and cassava. They vary in growth times and are at risk to damage by wild pigs. Gardeners use very approximate knowledge and undocumented planning. Although sweet potato, island cabbage and capsicum don't grow as well as other crops, their value and sales in the market are high. Disputes over the ownership of the land that their houses and gardens occupy also heightens market vendors' sensitivity and adaptive capacity.

ADAPTIVE CAPACITY

During interviews a number of existing mechanisms for adaptation were identified. These included methods for protecting crops, such as with shade or additional watering; and methods for preservation of root crops, namely sweet potato, taro, manioc and yams through solar drying. Sometimes, processing of products is a way to both add value and to preserve food. Banana and sweet potato chips are an example. Handicrafts, too, including pandanus mats, are recognised as a more resilient, or less weather dependent source of income. Some markets were found to be more entrepreneurial than others, so there is scope for market and crop diversification to be included as a strategy for climate change adaptation and disaster risk reduction across all the markets.

In assessing capacity for disaster preparation and response, there was a mixed level of knowledge of what to do. Some strategies named during the interviews were: selection of home and garden location (for example on high ground), and choice to evacuate / selection of evacuation location. This is usually a strong private house or nearby school or church but not all interviewees stated they would evacuate. Use of networks for early warning and messaging about disasters was assessed also. The usual method for receipt of early warning from NDMO is either from Radio Vanuatu or via text messages via the mobile network. However, coverage of both is patchy, particularly after a cyclone, and there is no agreed contract in place between the mobile networks and the NDMO. Word of mouth, on the other hand, is very reliable because the community and church are very strong. Men and women work together in the community; and generally communities will receive help from the church before the government.

5. Results: Ring Road Markets

Market Assessment

Design and Construction:

Due to their small size, the five ring road markets have been assessed together: Mele Maat, Mangaliliu, Emua, Paungagisu and Epau all suffered damage in cyclone Pam and many have not yet been rebuilt or repaired, though plans do exist. Only Melemaat and Emua are still operational. In addition, it is understood that there are some land ownership issues that complicate this process. Marketing does not take place in bad weather because of the poor shelter.

Location:

The Efate ring road locations are all low lying and close to the coast and therefore vulnerable to inundation in extreme weather or disaster. These are small community markets and therefore the market vendors generally have good access, in fact, commonly the market is closer than the gardens, which can be several hours walk away. Some are located on private land with no formal agreement for occupation of the land, which is a risk factor hopefully to be addressed through relocation of that market. Risk maps were unavailable for these markets except Melemaat, which was rated as highly vulnerable to tsunami and moderate vulnerability to flood. Judging by their location adjacent to the sea, all exhibit vulnerability, although it is the poorly protected coastal village communities that supply them that are most at risk.

Governance and Maintenance:

The Ring Road markets are governed by the chief of the village and often community committees are in place. E.g. disaster committee, water committee, women's group. Income from the market is personal and goes directly to the family who grew the product in their garden. In some communities, there was evidence of strong governance, for example, in Epau it was observed that all young men must have a garden for feeding their family before they are permitted to be married, and the chief gives the directive to stop market vending in order to conserve all food grown for feeding the family.

Facilities and Services:

These are very small, local markets with very little to no associated services. There is no water or power supply to the market, for example, though the possibility was discussed during the interviews. Likewise, these small markets have no drainage or waste management to speak of.

Transport:

The market vendors walk to the ring road market and access Port Vila main market by shared carrier for food and other supplementary supplies. Port Vila also offers an alternative location for selling produce and accessing the tourist market.

Table 3: RING ROAD MARKET ASSESSMENT					
	Cyclone	Drought	Flooding	Tsunami	TOTAL
Main building	3	1	3	1	**8**
Associated infrastructure	NA	NA	NA	NA	N/A
Produce sold	3	3	3	2	**11**
Governance and finance	1	1	1	1	4
Waterways	2	2	2	2	**8**
Disaster planning	2	2	2	2	**8**
Energy security	2	0	2	2	6
Water security	2	3	1	0	6
Accessibility	1	1	1	1	4
Transport	1	0	1	1	3
Drainage	0	0	0	0	0
Waste management	1	0	1	1	3

Interviews

EXPOSURE

The ring road markets are of course at high exposure to climate threats. They are small community markets, many of which were damaged or destroyed by cyclone Pam two years ago. The vendors' houses are often temporary dwellings and also affected. They largely sell fruit and vegetables and therefore are reliant on natural resources affected by the unpredictable weather and flood and drought during the wet and dry seasons every year. Some crops, such as island cabbage are at increased risk of pest and disease. Most of the ring road is at risk of tsunami depending on their relative proximity to the coast. Most have no response plan or alarm.

SENSITIVITY

Sensitivity is reduced by natural resources, good natural water sources supplemented by rainwater tanks (though in a strong El Nino event even these are compromised) and a rural banking service so that extra money can be saved for tougher times. These are small communities therefore governance is generally strong, depending on the chief and systems in place. The Ring Road markets are within easy reach of Port Vila, which further reduces sensitivity by providing them access to supplementary food supply, some of which is marked up for sale at their market, and supplementary cash opportunities such as catering and the Port Vila tourist trade. However, the proximity of Port Vila could be interpreted as leading to reliance on external supplies and assistance. These markets are heavily reliant on the Efate ring road infrastructure for access to the capital and for traffic to bring customers to their market also.

ADAPTIVE CAPACITY

The most effective adaptation available to the ring road market vendors are their small and close communities, in which women are involved in decision making and committees are in place to govern resources such as water, to support certain groups in the community and to take charge in an emergency. The adaptive capacity in Mele Maat community could be expected to be higher, given that this community was relocated by a volcanic eruption in the early 20th century. During consultation, the ring road market vendors raised a lack of knowledge within their communities regarding climate change adaptation and disaster response and asked for assistance in this area. They believe that valuable traditional knowledge is being eroded in Vanuatu, particularly on Efate with the close proximity of the capital and high Western influence, and without sharing and learning opportunities with Ni-Vanuatu from different provinces. They do not preserve food for disasters, for example, but rather rely on the proximity of Port Vila and foreign and government assistance. Foraging for food is available as a last resort.

When warning is received from the Metservice to NDMO it is passed on through radio and mobile networks and the Area Secretary. It is the responsibility of the Area Secretary to coordinate the response through the chief, church leaders, family networks and/or disaster committee. Gardens and houses are often damaged in the annual cyclone season, and risk is increased by the tendency for self-assessment of the strength of the house to withstand the disaster, despite the fact that there is usually a strong church or hall available as an evacuation centre, which can put people in great danger when they are forced to move from one location to another in the middle of a cyclone. Most interviewees are well-informed on action to be taken if notice of a tsunami is received.

6. Results: Luganville Market

Market Assessment

Design and Construction:

Luganville central market is housed within a large, solid, open air building. It was built in the 1980s and sells a range of fruit, vegetables and prepared food. No maintenance has been undertaken and therefore the roof leaks and the drainage does not have the capacity to deal with heavy rain. The market is always full, in fact vendors are on a rotational roster. Those selling or sleeping around the edge of the market are exposed to rain and sun. Because many vendors travel a long way, a week worth of produce is brought in at any one time, therefore much is left to be stored outside the marketplace, exposed to the sun and rain and spoils quickly.

Location:

The marketplace is close to sea at the mouth of the Sarakata River on reclaimed land (Fig. 10); it is relatively safe from flooding but at risk from tsunami. The riverbank is unprotected and experiencing some erosion. The risk maps show Luganville market to be at 'very high' risk to tsunami, with >8.0m inundation depth, 'low' wind and flood risk and 'high' overall combined risk (Fig. 11).

Figure 10: Layout and features of Luganville marketplace. Source: Google

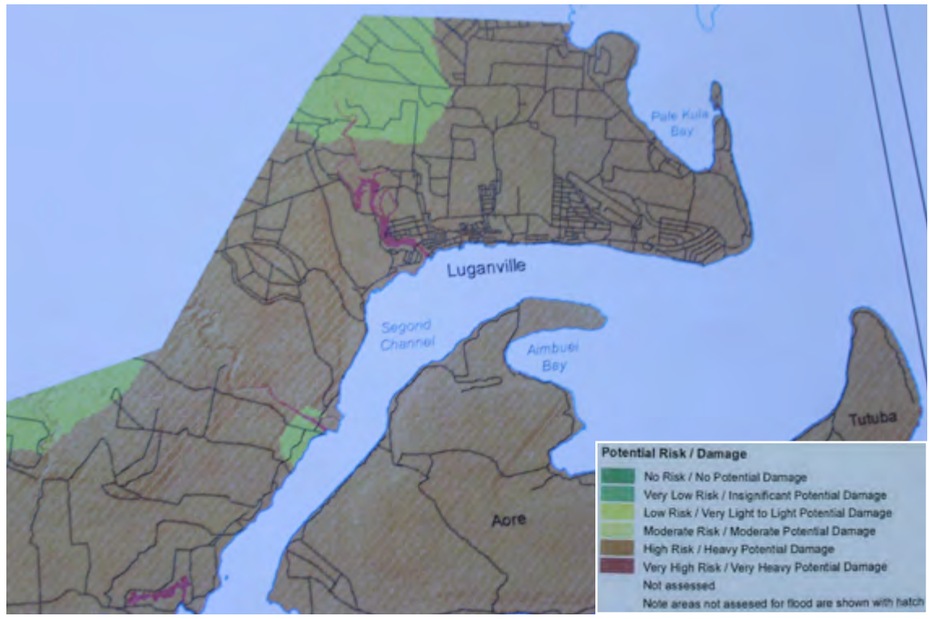


Figure 11: Combined overall risk map showing high risk at Luganville market, courtesy of NDMO

Governance and Maintenance:

The market is located adjacent to the governing council, which makes communication easy. There is a market manager in place and cyclical management of market vendors who come in at allocated days and weeks. The market has been poorly maintained due to lack of funding allocation. The drainage is blocked and security lights broken. No security is in place: there are no guards or fencing and some stealing occurs. Some training has been undertaken with the market vendors, though feedback suggests that in future, care needs to be taken to ensure that this is targeted and suitable for the literacy levels of the target audience.

Facilities and Services:

The market vendors travel from far away and must stay with their produce at the market for up to a week as there is no storage or accommodation available. The supply of electricity supply is mains but unreliable; there is a need for an alternative supply. Similarly, the market is reliant on town water supply, but there is also a small rainwater tank on site. Security lighting would help to keep the market safe and combat crime. There is a fairly good waste management system in place, with rubbish collected on a regular basis and composting of organic waste occurring.

Transport:

Vendors come from throughout Sanma province as this is the largest market. Some must pay large sums to travel to the market and therefore stay to sell large stocks of produce. This means that prices are high but does ensure a sustainable source of income for remote communities. There is plenty of space at the market for unloading and parking, but limited space for selling and storage, hence different market vendors are allocated different times for selling at the market.

Table 4: LUGANVILLE MARKET ASSESSMENT

	Cyclone	Drought	Flooding	Tsunami	TOTAL
Main building	2	1	3	2	8
Associated infrastructure	2	0	1	2	5
Produce sold	3	3	3	2	**11**
Governance and finance	3	2	1	2	8
Waterways	2	0	2	2	6
Disaster planning	2	2	2	2	8
Energy security	2	1	1	2	6
Water security	1	3	1	1	6
Accessibility	3	1	3	2	**9**
Transport	3	1	3	2	**9**
Drainage	2	1	2	2	7
Waste management	0	0	1	0	1

Focus groups

The second Focus Group workshop was with Luganville market vendors from across Sanma province, grouped according to the geographical area they are from. Santo Island is large and some parts are very remote, therefore differences in hazards and risks became obvious depending on location of the focus group.

There was therefore some variation between the seasonal calendars of the focus groups. The vendors agreed that there was often a shortage of food in May-July, and also during cyclone season from November-January due to progressively stronger wet/dry seasons and unpredictability. The east Santo focus group identified a long (Nov to May) cyclone season, and in addition observed that, these days, they are just as likely to see a cyclone in June. The group from Fanafo identified that though resources (food crops) are plentiful in December, the risk of tropical cyclone comes soon after: in January-March, putting at risk food supply, nutrition and source of income. Market vendors and their communities are constantly at risk of either drought or flood: "we have too much rain or we have too little: never just right amount". This shows the value that a good water management system could have, if there was an ability to store water until the time when it runs short. The hazardous time (Nov-Feb), when heavy rain and high risk of landslide as well as the risk of tropical cyclone affects finances, is also an expensive time for families with school fees and food for holidays. Collectively these factors must be considered in the development of action plans and disaster plans.

The historical timeline identified a long history of disasters for such a small island. The most common were cyclones and earthquake/tsunami which have occurred at regular intervals. There have also been a few notable human impacts such as land disputes and riots. As Santo is located a fair distance from Efate, different cyclones have hit with different intensities (or not at all).

The vulnerability matrices showed an even spread of risk to different resources and even spread of perceived vulnerability across seven hazards: cyclone, flooding, drought, earthquake, landslide, tsunami and land dispute. It is notable that the risk of all bar one (earthquake) are heavily influenced by climate change. The even spread of vulnerability may be a function of the

participants' wide ranging distribution across Santo, or indicate high and equal threat from all hazards.

Interviews

EXPOSURE

Interviewees at Luganville market claim to have noticed an increase in dry conditions and more unpredictable weather overall. They are regularly exposed to heavy rain (often causing landslides), cyclones and El Nino, which damaged crops (particularly cabbages), water supply and the health of livestock. A key lesson from tropical cyclone Zena in 2016 was the ineffectiveness - or complete lack of – an early warning system. Even those with a working radio or mobile did not receive warning of this cyclone, which did not hit Port Vila. Market vendors travelled to Luganville market as usual rather than staying at home or evacuating, which put them at risk and spoiled their market goods. The interviewees claimed that there is no risk of tsunami, although the NDMO risk mapping suggests otherwise.

SENSITIVITY

The market vendors sometimes walk an hour or two carrying produce down from the garden to the road. One in particular has four river crossings to negotiate on foot and more to navigate by truck and therefore cannot take produce to market following heavy rain. These kinds of difficulties increase sensitivity to climate change and disaster. Because of the costs and difficulties associated with reaching the market, vendors often stay two or more nights, or until all the produce is sold. Unfortunately, some produce spoils quickly, especially if not sheltered from rain and sun. For this reason, the resilient peanut crop is very popular. During heavy rain, the drains at the marketplace overflow and water leaks through the roof. The market needs better shelter so that fruit and vegetables can be stored for the week out of the sun and rain and market vendors can sleep and sell their goods comfortably for long periods.

When not at the market, the remainder of vendors' time is spent preparing the food and gardening. Crops in Vanuatu are regularly damaged by climatic extremes, and Luganville is no exception: some crops, such as banana, manioc and peanut are regularly destroyed by heavy rain. Cabbage and taro are easily waterlogged. Following cyclone Pam there was complete failure of many crops including bananas and yams. Soon after, El Nino affected water availability and the quality and quantity of all crops, particularly sweet potato, taro and kava. Food was limited to community consumption only, therefore incomes suffered and market prices increased. The effects of these events were still obvious at the time of this assessment.

ADAPTIVE CAPACITY

To adapt to these increasingly difficult circumstances, the vendors make conscious decisions about where to plant what, and have identified that by harvesting two times a year, and by harvesting different crops at different times, resilience is strengthened. Measures are taken such as growing the more resistant crops in different seasons and watering, particularly of sweet potato and tomato. Pests are also a problem increasing sensitivity but the vendors adapt by using nets to protect pumpkin, watermelon and cucumber; and fencing their gardens to keep wild pigs out. Peanuts are damaged by rats and the vendors have no control measures for this, other than replanting. During interviews, the women discussed the idea that more remote locations may in fact be more resilient due to less reliance on outside assistance, and traditional knowledge of natural resources such as the flowering of the navara to indicate the time for planting the sweet potato and taking edible worms from the sea during the full moon for making laplap in September and October. If they are fore-warned of disasters, families are able to prepare by preserving peanut, water taro and banana chips; or storing peanuts and mangos.

Most of the market vendors interviewed stated that they often hear about impending severe weather 'by chance', and don't feel well-informed about what to do. Because of a long history of cyclones, some held knowledge passed down to them through family. Families do make efforts to stockpile rice and other non-perishables. Information is broadcast from NDMO via radio Vanuatu or mobile network provider, but some have to walk long distances from their home (up to two hours) to get coverage, and of course would not like to do so in bad weather. Therefore, often messages are received by word of mouth from family, church or community members. The NDMO has a new initiative to set up Community Disaster Committees (CDCs) to communicate, prepare and respond in a disaster, however, some areas are not reachable by NDMO to undertake this work. Interviewees from Hog Harbour noted that there is a new CDC set up here, though it needs further capacity and resources. Cyclone damage to houses is common as most are not permanent structures. Therefore, lives too are at risk as it is uncommon to vacate or evacuate unless absolutely necessary. It is also common to continue to sell in the market in dangerous conditions because the income is so badly needed and no controls are in place. During cyclone Zena, police were brought in to close the market and market vendors sheltered in a local hotel, at the cost of a good Samaritan.

Budgeting is important for adaptive capacity, but when money is short the market vendors find it difficult to plan ahead, and their income can be quickly wiped out if crops are damaged, access routes are blocked or markets are closed. Some have secondary sources of income such as kava, copra, cattle and tourism. Schooling and transport of goods to market, are very significant costs.

CASE STUDY 1: Lacknapus Piggery Project: Black Sands Area, Port Vila

A practical experience was shared by one of the participants who practices pig-farming, describing how her livelihood was threatened in the aftermath of Cyclone Pam. While all of her pigs were accounted for after the cyclone, problems were encountered when food stocks began to run low: there were no greens for almost two months and no coconuts for over five months, and an increase in price of old bread, meat meal and copra meal raising serious concerns of how to continue to feed the pigs. In contrast, a neighbouring piggery with a disaster preparedness plan had preserved and dried root crops in the lead up to cyclone season. The dried food simply needed to be soaked in water and was then reconstituted for feeding to pigs, ensuring a more resilient and sustainable livelihood.

7. Results: Marobe Market

Market Assessment

Design and Construction:

Marobe Market was established in 1989 and the current markethouses - one for fruit, vegetables and handicrafts and one for livestock - were built in 2013. Both are well-built with a concrete base and open sides, withstanding category 5 cyclone Pam with almost no damage; and lots of space for storage and marketing of produce.

Location:

The market has an unusual location set far back from the main road amid residential/industrial land use (Fig. 11). A loud quarry operates next door. Without a doubt, the market would attract more customers if located closer to the road. The market is important nonetheless as it offers accommodations and a dedicated selling space to both market vendors that travel from far away, and local backyard farmers; as well as food to local residents and handicrafts for tourists.

The water table is high here and the nearby rivers are said to be prone to flooding. However only minor surface flooding has been experienced at the market in the last two years. The closest waterway is located approximately 300m to the south. The risk maps show Marobe market to have combined potential risk of 'moderate' (Fig. 8).

Figure 11: Layout and features of Marobe marketplace. Source: Google

Governance and Maintenance:

Shefa Province has a market manager in place to govern and maintain the market, who works closely with the MVA and M4C programme. Vendors are charged 200Vt/day which goes directly to Shefa Council. Most vendors come from far away islands such as Santo for a week or two at a time to get a good price for their products that they can then take back to their families. Though there is some risk from tsunami and flood here, no formal disaster planning has been undertaken. Market vendors do not sell on stormy days. The market does however offer a backup location in the event of damage resulting in the closure of Port Vila market as occurred after cyclone Pam.

Facilities and Services:

The marketplace has a reliable and affordable mains water and electricity supply. There are no drainage problems, and livestock waste drains to a soakaway. There is not a lot of solid waste generated; it is collected, composted or burnt. The access gates are able to be locked at night, market vendors are provided with safe accommodation and ablutions, and opening hours are upheld, but despite all this, due to its secluded location, Marobe is prone to intruders.

Transport:

Market vendors often travel long distances, even from outside the province, by boat and/or truck. Often sales are by an association, which can send people to and fro with profits and supplies.

Table 5: MAROBE MARKET ASSESSMENT

	Cyclone	Drought	Flooding	Tsunami	TOTAL
Main building	1	0	1	1	3
Associated infrastructure	1	0	1	1	3
Produce sold	2	3	1	1	**7**
Governance and finance	1	1	1	1	4
Waterways	0	0	2	1	3
Disaster planning	2	2	2	2	**8**
Energy security	1	1	1	1	4
Water security	1	2	1	1	5
Accessibility	2	0	2	2	**6**
Transport	2	0	1	1	4
Drainage	1	1	1	1	4
Waste management	1	1	1	1	4

Interviews

EXPOSURE

Marobe market might be said to be less exposed to disasters than the other markets. But it is also less populated due to its distant and isolated location. It is unfortunate that centres of human activity tend to develop in high risk locations. Marobe was not immune from to the impacts of cyclone Pam and El Nino, and the vendors, many of whom travel from other islands and provinces have observed their dry season to be worsening. Tsunami warnings are common, though the risk maps do not denote a severe threat. The interviewees always evacuate to high ground in the event of a tsunami warning but never has a wave eventuated.

SENSITIVITY

Marobe market is well managed and well built, and therefore less sensitive to risk, but the root crops that are so commonly sold here such as sweet potato and island taro are affected by both drought and flood.

Vendors did not feel well informed about disasters. Radio Vanuatu and the local news deliver information but it doesn't reach everyone here. In a disaster they would leave the market and evacuate to a stronger house if there was a perceived need or message received to do so.

ADAPTIVE CAPACITY

In an effort to adapt to climate change, Marobe residents and vendors try to select crops that are more suited to the soil and more resilient, such as manioc and cassava. They supplement their income with handicrafts which are more resilient to the climate and some manage to save some of their profit for disaster preparedness. They also make use of wild yams as a food source during disasters, as there is no often no external support in disaster.

CASE STUDY 2:
Food Redistribution: Saratamata, Ambae

Leftover produce, usually root crops but occasionally fruit or meat from Ambae is packed and sent to Port Vila for sale. Coordinated through a Facebook page, this scheme saves vendors the costs of taking their unsold produce home, permits them to earn additional income, and provides a guaranteed minimum weekly income for budgeting with. Additional benefits are reduced waste and cheaper and more nutritious food for those living below the poverty line in Port Vila. There are plans to link this cooperative concept with Marobe market.

8. Discussion: Vulnerability Profiles

Table 5: Vulnerability Comparison

EXPOSURE	Port Vila	Luganville	Marobe	SENSITIVITY	Port Vila	Luganville	Marobe	ADAPTIVE CAPACITY	Port Vila	Luganville	Marobe
Coast proximity	3	3	2	Natural resources (/crops)	2	3	2	Governance	2	3	2
Coastal protection	3	3	1	Market construction	2	2	1	Financial resources	1	2	2
Waterway proximity	2	3	1	Market maintenance	3	3	1	Knowledge & awareness	2	3	2
Waterway protection	1	1	1	Security	3	2	3	Infrastructure & technology	2	3	3
Flood plain	1	2	1	Energy source	2	2	2	Preparedness	3	3	3
Ground/soil type	2	2	2	Water source	2	2	3				
Wind risk	2	2	3	Vendor literacy	2	3	2				
Tsunami risk	2	2	2	Accessibility	2	3	3				
TOTAL	**16**	**18**	**13**	**TOTAL**	**18**	**20**	**17**	**TOTAL**	**10**	**14**	**12**

Port Vila Market

Given its location on the coast, Port Vila market is particularly vulnerable to sea level rise, storm surge, tsunami and cyclone. This risk is magnified by the fact that the drainage is blocked, the water tank discharge pump broken and roofing lacks adequate spouting and flashing. These maintenance issues, combined with sea level rise and location lead to high risk of regular flooding of the market under heavy rainfall conditions, and guaranteed flooding in the event of a cyclone or tsunami.

Issues to be aware of affecting vulnerability specifically at Port Vila market are its location in the CBD, as the most urban of all the markets assessed. This increases risk through social issues and a lack of security features: there is no perimeter fencing, gate or closing hours, there are pre-existing social problems such as alcoholism and crime associated with the proximity of night clubs and a weaker community structure, conditions that are exacerbated during disaster.

The strengths of Port Vila marketplace are that the main building is strong and well built, there are a variety of livelihoods/income sources available to the market vendors and not all are affected by weather and climate, and there is a large network of people for education, communication, awareness and outreach.

Priorities for action at Port Vila are correction of the drainage issues through investment in infrastructure, development and communication of a disaster preparedness plan to ensure timely action, and transparency in governance to ensure that the market is well-maintained, operations well-governed and finances well-managed.

Luganville Market

Luganville market's location is also high risk. In fact, there are a number of hazards including cyclone, tsunami, flood and drought which threaten this market. Currently food prices

remain very high, which is a concern for the council because it has the potential to affect food supply and nutrition. However, given the long and expensive transport distances, the residual lack of supply following a prolonged El Nino event, and the increasing pressures of climate change, costs can be expected to continue to increase. The council has fixed the prices of most products, which puts pressure on the livelihoods of market vendors, increases their vulnerability to climate change and does not address the root cause of the problem, being transport infrastructure and costs and accessibility of the market.

Priorities at this market must be drainage improvements and riverbank strengthening to address high risk to the market of flood and erosion, and transport infrastructure focus to address the cost of produce. An upgrade of the roof, fish sales area and waste area have also been identified as priorities.

The strengths to take advantage of at this market are its strong rural community, some existing disaster committees and awareness in some places. Market vendors need ongoing awareness and training in climate change and disaster preparedness, therefore recommendations include development of a plan to prepare and respond in a disaster and reinstatement of the public address system for early warning and communication.

Because Luganville is a small town and Sanma province is far from Efate and Port Vila, certain vulnerabilities arise. For example, Cyclone Zena showed that often weather information and disaster advisory messages are very specific to Efate Island and notalways relevant to Santo. Also, poor accessibility and high costs of transport to distant islands mean that those residing in Sanma Province, or any Province other than Efate are better off to develop self-reliance and disaster-preparedness knowledge rather than awaiting assistance.

Marobe Market

When compared to the markets above, Marobe market is in a safer but less desirable location for marketing. It remains at risk of flood and tsunami but its location away from the sea, the city, on higher ground and in a well-built structure make it less of a priority for climate change adaptation plans. Despite this, it would benefit from some basic improvements and a disaster preparedness plan. Its main drawback is its isolated site which is unsafe at times and lacks the foot traffic that would make it a more successful market.

Ring Road Markets

All of the ring road communities except Mele Maat are coastal and therefore at high risk of sea level rise, coastal inundation and tsunami. The ring road markets are at increased risk due to the poor infrastructure and resources available to them on the roadside of Efate Ring Road. However, they also house a smaller number of market vendors. Therefore, while they need immediate attention they are not the highest priority for significant investment. The ring road market vendors have the advantage of strong communities and showed an interest in improving their knowledge of agriculture techniques and in particular, improved sharing of traditional knowledge.

Limitations

The methodology employed for this study successfully assessed exposure, sensitivity and adaptive capacity at the three main M4C market sites and selected ring road sites, enabling clear recommendations to be made to reduce risk and to ensure that climate change adaptation plans and disaster plans can better reflect and address these risks. It is important that the findings of this study are not considered to be static. Existing vulnerabilities that have been identified will change, and new vulnerabilities will emerge. The findings are somewhat representative of the time of year the research is undertaken, the year and the participants involved. Therefore, the vulnerability assessment ought to be reviewed, plans updated and changes implemented over time through adaptive management and ongoing consultation. It was difficult to fully explore the differences in vulnerability of men and women respectively in this case and it would be interesting to have segregated focus groups by sex to see if clear differences of this nature are evident.

Next Steps

The findings of this study must be aligned with national, provincial and local planning instruments, and be widely communicated, in particular to stakeholders and participants of the study to ensure relevance, uptake and success of the recommendations. To ensure that the findings are beneficial to market vendors, the next step is to continue with disaster preparedness and management planning to strengthen the capacity to adapt and respond. It is important that lessons are learnt from the design shortcomings of the markets so that mistakes are not repeated or exacerbated in future. It is also important that the recommended changes to be made at the market are fully assessed, discussed and agreed by authorities and stakeholders so that a well consulted and suitable plan for action can be developed and implemented.

9. Recommendation

PORT VILA		
	SHORT-TERM	**MEDIUM-TERM**
Market Infrastructure	• Access via the front loading bay is currently uncontrolled and busy, causing congestion and safety concerns. A proposal exists to erect fencing around the market to improve security, particularly at night, and control access during a crisis. • The uncovered area in the middle of the market does not drain properly resulting in severe flooding: the drainage system needs to be cleared and jetted regularly, and the pump fixed for easy discharge to the harbour during times of heavy rain. A formal maintenance regime is recommended. • Improvements to the roof such as flashing, spouting and shutters to better control water during heavy rain, and to improve the quality of rainwater harvesting. • Reinstate PA system to improve communication within the market and to ensure an effective early warning of disasters such as cyclones.	• A storage area at the market for vendors who travel long distances with large amounts of market produce. The current lack of storage means that out of town vendors cannot leave the market for many days and if evacuation were necessary they would be reluctant to leave the market unguarded. • Market vendors do not have accommodation in Port Vila. Most sleep on the floor or tables of the market. This is apparently not permitted but no alternatives are offered. It is recommended that alternatives are investigated. • Investigate the funding and implementation options for solar power which would make use of the large roof and high sunshine hours, reduce electricity costs and offer a cheap and sustainable power supply.
Market Governance	• Greater transparency in regards to financial management of the market.	
Disaster Risk Reduction	• Draft and finalise, with full stakeholder input and review, a market Disaster Preparedness Plan focused on cyclone/flood and the markets and gardens as the highest priorities identified in the vulnerability profile; and including an evacuation protocol following the recommendations of the government disaster plan (once released).	• Immediate and ongoing communication and awareness of the disaster preparedness plan to inform people of the risks and action to be taken. As both a known high risk area and a centre for communication, the market offers the perfect place for distribution of information to communities, e.g. by noticeboard in market hall with hazard-specific key advisory messages and leaflets to a) keep people safe and b) ensure business continuity. This could be the responsibility of the market manager or an elected market focal point.

Capacity Development	• Raise awareness of climate change risks and disaster preparedness and response actions and responsibilities, including DRMP and poster for communication to vendors and display at the market. Focus on cyclone/flood and market/ garden as priorities raised in the vulnerability profile.	• Build knowledge and skills of agricultural adaptation strategies such as crop selection, productivity and diversification through training modules which take account of traditional knowledge identified during the interview process and low literacy rate.

RING ROAD	
Market Infrastructure	• Full re-build is required in the wake of cyclone Pam (two ring road markets completely destroyed, two with temporary structures). In the case of Emua, relocation is necessary because of land ownership issues. Vendors would like market to be a strong, safe place with more space, better protection from rain and toilets and handwash facilities
Disaster Risk Reduction	• Community development planning will be undertaken by the government. This process encourages the community to identify risks and will be able to inform a disaster preparedness plan that is aligned with the community plan and managed by the community disaster committee. The priority disaster planning recommendations of this report are therefore for the larger municipal markets which have no pre-existing plans in place, nor a proposal for their development. It will be important that the ring road market communities recognise risk factors specific to their location such as proximity of the coast and waterways that are prone to flood and have a clear plan for evacuation and individual/group responsibilities.
Capacity Development	• Some individuals made the point that they would appreciate information or training on food preservation, disaster preparedness techniques and sharing of traditional knowledge (e.g. breadfruit preservation techniques from the Banks Islands). This may help to increase the resilience of crops and the sustainability of the produce sold, and should feed directly into the community development planning and disaster planning processed outlined above.

LUGANVILLE		
	SHORT-TERM	**MEDIUM-TERM**
Market Infrastructure	• Repair or replace the leaking roof. • Repair or replace broken PA system to improve communication within the market and to ensure an effective early warning of disasters such as cyclones. • Improvements to stormwater drainage through Luganville town (not simply at the market).	• Construct a gabion wall along riverbank at rear of market place to strengthen the riverbank against erosion while adding amenity value to the market. • A purpose-built fish sales area to improve food hygiene and supply and demand for fish at Luganville market, indirectly improving community nutrition. • Investigate the funding and implementation options for solar power which would make use of the large roof and high sunshine hours, reduce electricity costs and offer a cheap and sustainable power supply.
Market Governance	• Investigate methods for monitoring the extremely high fruit and vegetable costs at the market, which are a result of high transport cwosts. The current strategy is price fixing but it remains to be seen whether this will be effective or problematic and there are no plans for assessment.	
Disaster Risk Reduction	• Draft and finalise, with full stakeholder input and review, and awareness and communication strategy, a Market Disaster Risk Management Plan. This plan should focus on the highest priorities identified in the vulnerability profile such as transport and accessibility, and align with NDMO and local government processes and plans.	• Ongoing communication and awareness to ensure uptake and implementation of the disaster preparedness plan. • The disaster plan must include contingency plans for offering safe accommodations to these vendors who are stranded far from home during an unexpected disaster as there is no accommodation available for market vendors who travel long distances and must stay many nights. This could be money from market revenue that is put aside by the market manager to cover a few nights in a safe motel during dangerous weather.

Capacity Development	• Raise awareness of climate change risks and disaster preparedness and response actions and responsibilities, including DRMP and poster for communication to vendors and display at the market.	• Build knowledge and skills of agricultural adaptation strategies such as crop selection, productivity and diversification through training modules which take account of traditional knowledge identified during the interview process, and low literacy levels in remote areas.

10. Conclusion

It is well known that Vanuatu is severely vulnerable to climate change and disasters. In fact, according to the 2016 World Risk Report it is ranked the most vulnerable country in the world (Garschagen et al., 2016). Overall, exposure is high, as evidenced by the risk maps supplied from the NDMO (overall combined risk was rated 'High' for Luganville and Mele Maat, and 'Moderate' at Port Vila and Marobe), the reliance on agriculture and impact of severe weather and the strong seasonality of the dry and wet seasons as shown by the seasonal calendar, and the long history of disasters, in particular cyclone and tsunami as summarised in the historical timeline exercise.

Vanuatu is a developing country and therefore sensitivity is also high. Influencing factors shown in the vulnerability matrices include reliance on natural resources, low literacy and education levels, governance issues around tribal land ownership and dispute, poor access to technology and financial resources for investment that are either not available or accessible.

The interviews collected a number of opinions and case studies, in particular from women, and in fact, recorded many coping mechanisms that suggest surprisingly high adaptive capacity considering the limited resources available. Men and women work together and often women control the household finances. Interesting discussions were had around urbanisation, and it was suggested that urban areas dilute resilience. Certainly the evidence shows that traditional knowledge is more evident and valued in rural and more remote areas. Also, more remote communities are better equipped, prepared, and better positioned to help themselves during a disaster. Partly this is out of necessity as such communities are not able, under normal conditions, to supplement their lifestyle with supplies from the city, and it is difficult for the government assistance and foreign aid to reach them, even in normal conditions. Also, the Vanuatu people have a long history of land occupation and have developed traditional knowledge of the natural resources available to them at their island of origin. New or adopted locations without a long history cannot be said to have the same level of traditional knowledge of local conditions and resources.

Going forward, key recommendations are to make use of existing knowledge and traditional techniques, and to share and build on them. The UN Women Markets for Change team has the ability to influence the infrastructure at the markets, therefore an action plan will be developed from the recommendations (Section 8) of this report so that gradual improvements can be made at each market location by following this plan and budget can be allocated to these activities when available. The larger markets commonly require roofing, drainage and security improvements, while the key needs at the ring road markets relate to land and rebuild and marketing assistance. All market communities should have a minimum level of knowledge and understanding of techniques for adapting to climate change, and a disaster plan must be developed for each municipal market or ring road community in close consultation with stakeholders such as market manager and local NDMO officer, and clearly communicated to the market vendors. Overall, it is critical that the focus is on local knowledge and ideas, that the plans are fit for purpose and specific to the setting, and flexible enough to allow for the challenges of a developing country setting.

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APPENDIX ONE: Market Checklist

Market Vulnerability to Climate Change Project: Field Assessment Form

Survey Details:

Market Name:		Market Location:	
Lead Assessor:		Date:	
Other Assessors:			
Comments:			

Environmental

Map
2.1 Building: Full description including type, age, materials and footing (attach map and aerial/oblique photos)
2.2 Associated buildings and facilities: List all market buildings and facilities (attach map and aerial/oblique photographs)
2.2a Main Produce sold

2.2b Security
2.3 Governance and finance mechanisms:
Describe current management structure
2.3a Disaster Risk Reduction measures:
Describe efforts to date
2.4: Waterways, coast and other natural features:
Add to map and comment on nature and quality

Services:

3.1 Energy: Comment on source, supply, reliability and costs
3.2 Water: Comment on supply, source, reliability, quality and quantity
3.3 Accessibility and Transport: How are goods transported and unloaded? How to vendors and purchasers access the market? Map access routes on map.
3.4 Drainage (engineered/natural): (add to map, if evident)
3.5 Waste management: How is waste manged, where, how and on what surface is it stored and how often is it removed? Are health concerns evident?

APPENDIX TWO: Interview Questionnaire

Market Vulnerability to Climate Change Project – Research Interviews			
Date and Time		Location	
Name		Age	
Occupation		Gender	

1. Resilient Livelihoods	1.1: What do you sell and where does your produce come from?
	1.2: How far do you travel and how? Is it reliable?
	1.3 From where do you get food and water for your family? Is there enough?
	1.4 What previous weather events do you remember and what were their impacts on the market/your income/your family/your welfare?
	1.5 What changes in climate have you noticed over time? Is weather more/less unpredictable?
	1.6: How variable are crop yields? When is the most difficult time of year/climatic event? What crops are usually low? Why? How do you cope?
	1.7: Is demand increasing, decreasing or staying the same?
	1.8: Do you use any weather information for planning? How are you warned early of coming disasters/extreme weather?
	1.9: Do you use any techniques to improve crop resilience?

2. Disaster Risk Reduction	2.1: What are the biggest climate-related hazards? Non-climate related hazards?
	2.2: Do you have protected reserves of food and agricultural inputs?
	2.3: Do you have secure shelter? (traditional/modern housing, evacuation centre)
	2.4: Are livelihood assets protected from hazards?
	2.5: Are you able to escape danger in a disaster? Do you feel well-informed on what to do in a disaster e.g. cyclone, flood, drought, tsunami?
3. Finance	3.1: Are social and economic safety nets or financial services available? E.g. welfare benefits, earthquake levy, loans, insurance
	3.2: Do you have other sources of income? What are they?
	3.3: Do you plan for /save or invest in the future?
4. Addressing Causes of Vulnerability	4.1: Do men and women work together to deal with problems?
	4.2: Do households have control over critical livelihood resources? E.g. land?
	4.3: Do women (and marginalised groups) have equal access to information, skills and services? resources?
	4.4: Are there other factors that make some people in the community more vulnerable than others?

APPENDIX THREE:

Market Assessments - Port Vila

Environmental:

1.0: Location:

The market location is bound by Port Vila harbour to the west, the main road through town to the east, the Bon Marche supermarket to the south and neighbouring vacant land. The market is well located for accessibility but at very high risk to tsunami, cyclone, storm surge and the like.

2.1 Building:

The main market building is large, strong and of solid construction to weather a category 5 cyclone with little damage. It was built in approximately 1985. Its turtle design with a hole in the middle results in severe flooding. There is some shade cloth erected for protecting this area.

2.2 Associated infrastructure:

The market has attached toilets and showers and market office. It has a cooked food section which was added on to the rear of the building. A proposal exists for storm shutters to protect during a cyclone. There is no storage space and no accommodation despite the fact that many market vendors stay for up to week to sell their products. These women sleep on the floor of the market.

2.2a Main Produce

The market has clear sections selling flowers, fruit and vegetables, cooked food, handicrafts and clothes. Vending follows a weekly pattern. Many vendors come in to the city for several days or the whole week, and numbers accumulate until Friday. Saturday is a short day.

Security

Security guards are employed and work overnight but security remains poor and said to be worsening with increased recent stealing at night. The market is not fenced and is never closed. CCTV was set up at the time of the research. Opening hours are 730 Mon-200 Sat.

Governance and finance mechanisms:

Each market vendor pays a daily fee for their table. 34% of this goes the council. Since March 2015 the market manager has had an office set up in the market and has controlled the market revenue, though its unclear how transparent this new system is. The market manager has plans to set up additional, satellite markets outside the town. Staff includes cleaners, trainee supervisor, finance officer toilet keeper, collection staff, security and driver – total workforce 12.

2.4: Waterways, coast and other natural features:

Very close to coast – results in flooding

2.5: Disaster Risk Reduction:

No plan in place. Significant need for plan. In TC Pam, much damage occurred. Flooding throughout market, tables washed away, Mamas returned to their village and market was closed for approx. 1 month. Despite early warning vendors continued to come in and did not evacuate. Had to be removed by police. There was no bridge, no food, some outer islands came in with produce but was marked up for transportation. Prices have never really come back down. Price setting attempted to help. Followed on by EN. Flooding is common due to poor drainage. Preparedness Plan.

Services:

3.1 Energy:

Mains electricity for lights etc. - open until late. No alternative source of power.

3.2 Water:

Mains water. Tanks are for cleaning water (non potable) only. Rainwater tanks don't collect rainwater!

3.3a Accessibility:

Front loading bay uncontrolled and subject to congestion. And affects main road of PV. Market vending is dependent on bridges/ roads

3.3b Transport:

Vendors travel by road for far and wide. Private transport is arranged daily. Some go home regularly, some must stay whole week.

3.4 Drainage (engineered/natural):

he most severe problem. Gaps in the roof let water in. No spouting. Pipes beneath are blocked. Pump to sea no longer works Drainage - jetting regularly, spouting, fix pump and front and back drains

3.5 Waste management:

Waste is removed by truck regularly but sometimes collection system fails (eg truck breaks down) and rubbish builds up. A cart runs around the market to collect rubbish which is trucked away from PV up to 3 x day and taken to dump. Compost is also taken offsite. MM says it has improved this year

APPENDIX THREE:

Market Assessments - Marobe

Environmental:

1.0: Location:

Quarry next door is very loud and dusty. Peri urban area, surrounded by some industry to the south and farmland to the north and some residential. Promotes backyard gardening to the local residents.

2.1 Building:

Market since 1989. UNW and NZ Aid built in 2013.
Built to withstand cat 5 cyclone, proven by pam – no damage. Open sides, concrete base.

2.2 Associated infrastructure:

Accommodation and ablutions, livestock market house.
Lots of space, container storage, office and storage room.

2.2a Main Produce

Fruit and veg (building 1) – root crops, bananas
Handicrafts and cooked food sometimes
Livestock (building 2) – pigs, chickens, goats
Customers are mainly locals.
Each month one provinces comes to sellbut this arrangement is very flexible and some stay a long time eg 6 months. Market is open every day
Daily market but less farmers coming now. Hopes to attract tourists.

Security

Very prone to intruders – industrial surroundings, set back from road. Both gates locked at night; fenced; Open 6am-8pm ish
Crime and stealing occurs eg break ins at night due to isolation and low numbers of people around
Safe storage at rear

Governance and finance mechanisms:

Manager by Shefa Prov Council, market manager in place, in close working relationship with MVA and M4C programme. Vendors are charged 200vt /day and 100V for accommodation. All proceeds go to council. Small in size growth very slow. Providing a service rather than profit-driven. Assisting farmers by giving a place to sell. Priority is given to local farmers and those from provinces.

2.4: Waterways, coast and other natural features:

Closest waterway is river approx. 300m to the south but water table very high – 2-3m so needs proper drainage system. Prone to flooding with high water table and river in both directions but in two years only minor flooding experienced.

2.5: Disaster Risk Reduction:
No disaster plan in place for the market. Area Council responsibility (tsunami plan may exist Within tsunami risk zone (check), prone to flooding (check). Little cyclone risk, acts as a backup location for PV market eg TC Pam closed PV for 2-3 weeks. Not clear who takes charge in disaster, Market Manager?. Stops operation in bad storm – esp if windy as no shelter

Services:

3.1 Energy:	
Reliable, reasonable cost. Mains supply	
None	
3.2 Water:	
Reliable supply - municipal	
None	
3.3a Accessibility:	
Accessible to main road; far from centre of town, not very accessible for customers. Road maintenance poor,	
3.3b Transport:	
Transport from provinces is by boat. Often an association so that some can stay and sell, others take money back	
3.4 Drainage (engineered/natural):	
Natural drainage, some engineered drainage. No significant problems, some potholes and mud at front of site. Livestock waste runs to soakaway	
3.5 Waste management:	
1. Compost pile at rear, 2. Tins, plastic stored at back of livestock market for collection 3. Rest is burnt next door 4. little waste so easily dealt with, but exposed to wind.	

APPENDIX THREE:

Market Assessments - Luganville

Environmental:

1.0: Location:	
Close to sea and river. Low and Risk maps suggest high risk though sheltered by island. Market vendors around the island are at risk of numerous types of disasters. Most market vendors are women. Men are often at home looking after the kids. Women must sometimes walk long distance to the garden (2-3km) and travel long distances to the market (no roads). They carry market goods by hand and they often have no time to clean the house.	
2.1 Building:	
Well-built and cyclone proof structure but tired and poorly maintained e.g. holes in the roof. On reclaimed land. Built with good roof and good drainage but old.	
2.2 Associated infrastructure:	
No improvements seen since establishment of M4C. PA system in place but broken. Solar security light is in place but broken. Market office; toilets; cooked food outlets. It is very difficult for the women to leave their post in the event of a disaster or unplanned closure as they arrive with a whole week worth of produce and there is no storage or accommodation available.	
2.2a Main Produce	
Range of mainly fruit and vegetables including much root crops, peanuts, some cooked foods and prepared snacks. Laplap etc. EN: severely dry for six months – impact on families = crops low, esp. root crops, yams, kumala, taro – all the staples. Families have to rely on rice and other imported foods. All very seasonal. Starting to come back now.	
Security	
Some crime and stealing from the mamas at night occurs – most sleep in the market with their produce overnight, sometimes for several days. No fencing or gate and therefore always open. No security employed though there is security for the municipality next door. NZ Police visited last year to assist with safety.	

Governance and finance mechanisms:

Market manager – Kathy Leo; MVA pres. – Gloria from DWA
Financial literacy training was successful though pitched a bit high. Has encouraged some mamas to open bank accounts for savings and opened up access to loans. Future training needs to be based on role plays, verbal and practical. Useful training would cover maximising yield from crops to increase capacity. Women are heavily involved in all aspects of planting, growing, marketing and selling. Vendors pay 200VT/day plus extra for floor space, shower bath. Market revenue goes to municipality with no return for maintenance. Council pays for electricity and water direct. Much is owed to the electricity company

2.4: Waterways, coast and other natural features:

No major flooding but regular surface flooding and some occasions when mamas have to sleep on the tables. Situated very close to the mouth of the Saramata? River and the coast and experiencing some erosion.

2.5: Disaster Risk Reduction:

Literacy a complicating factor – v. v. low for some vendors. Financial literacy training was well received but pitched at high level. Schooling is very expensive and out of reach for some. (30,000-40,000VT/child per term and families are large).
The market is either closed in the event of a disaster, or no vendors come to the market.
TC Zena came right through Luganville with little warning received by vendors . A local lawyer paid for her mother and other vendors to stay at a local motel for this night.

Services:

3.1 Energy:

Mains supply only – on and off sometimes. No action on this from M4C. Secondary power would be beneficial. Security lighting also needed

- Solar power option

3.2 Water:

Council water supply at food stalls is used by the mamas as needed. It is too small to service some many people and a distance from where it is needed. In dry periods there is no council restriction. Mnay villages have wells. Some have tanks but there is a need for more tanks

3.3a Accessibility:

Access is good; plenty of space. Unsealed area.

3.3b Transport:

Market vendors travel from far and wide by private shared truck or boat on a weekly rotational schedule. Increases cost of produce, ensures an income for these remote communities.

3.4 Drainage (engineered/natural):

Good drainage, well designed and seems free of debris but complaints of surface flooding are present = either a result of the leaking roof or the capacity of the drainage in heavy rain. The mamas around the outside get wet.

3.5 Waste management:

All is carried in baskets, some is sold in plastic. Composting is in place, and used in market gardens. There are separate storage locations for compost and for usual waste (but contains much organic waste). Is removed once daily to tip outside of town for health reasons. No change implemented by M4C in this area. JICA implemented compost system.

RECOMMENDED IMPROVEMENTS:

1. Stabilise riverbank
2. Reinstate PA system
3. Training on maximising crops (careful targeting)
4. Fish sales area needed
5. Drainage improvements necessary given flood risk
6. Maintenance incl. roof

APPENDIX FOUR: Datasets

SEASONAL CALENDAR												
EVENTS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
SEASONALITY												
Dry season					x	x	x	x	x	x		
Wet season	x	x	x	x								
INCOME												
Catering / cooked foods	x	x	x	x	x	x	x	x	x	x	x	x
Handicrafts (Marobe)	x	x							x	x	x	x
Seasonal workers absent	x	x	x	x	x	x	x	x	x	x	x	x
Food selling	x	x	x	x	x	x	x	x	x	x	x	x
kava selling	x	x	x	x	x	x	x	x	x	x	x	x
Coconut selling	x	x	x	x	x	x	x	x	x	x	x	x
EXPENSES												
School fees		x			x			x				x
Holidays	x											
Festivals			x		x			x	x		x	x
LIVELIHOODS												
Seasonal workers absent	x	x	x	x	x	x	x	x	x	x	x	x
Community day / activities	x	x	x	x	x	x	x	x	x	x	x	x
Church day / activities	x	x	x	x	x	x	x	x	x	x	x	x
Gardening	x	x	x	x		x	x	x	x		x	x
Clear bush	x	x				x						
Plant yam								x				
Harvest yam			x	x	x							
Plant veg		x	x	x								
Harvest veg						x	x					
Plant manioc and kumala				x	x							
Harvest manioc and kumala									x			
Plant banana	x											
Gather fruit - melon, pineapple, mango											x	x
Plant watermelon?			x									
Harvest watermelon											x	x
Plant root crops (cassava)							x					
Harvest root crops	x	x										
Plant taro									x			
Harvest taro			x			x						
Harvest seeds								x	x			
Workshops								x	x			
Building houses	x					x	x	x	x			
HAZARDS												
Cyclone	x	x	x	x							x	x
Flood	x	x										
Drought					x	x	x	x	x	x		
Water shortage							x	x	x			

EFATE HISTORICAL TIMELINE		
YEAR	EVENT	IMPACT
2016-17	La Nina - rainy season	Vegetables rot, road flooded, no market
2016	Eviction order, Efate Ring Road	Property damage
2015-16	El Nino - dry season	Garden dry, no water, no market, no food for livestock
2015	Arrest of 11 govt ministers	Schools and shops closed, citizens frightened
	Late Natarei (David)	??
	Cyclone Pam	House, garden, trees, marine life damaged
	Heavy rain	Flooding, garden damage, no market
2014	SVMV established	Finance and knowledge
2011	Heavy rain	Flooding, garden damage, no market
2009	Earthquake	Damage to shops and houses
2001	Earthquake	Tsunami warning, damage to houses, Teoma Bridge and roads
	Lk Yasur volcanic eruption Tanna	Houses damaged, people evacuated
1999	Strong Earthquake	Mostly superficial damage
1999	Strong Earthquake	
1998	Riot	No money, damage to building
	La Nina	Flood, damage garden
1987	Cyclone Uma	Damaged water supply, garden, no market
1986	Cyclone Bola	Damage
1980	Independence	
1977	Riot for Independence	Police presence, deaths

	Human event (positive)
	Human event (negative)
	Natural event - weather
	Natural event - seismic

EFATE VULNERABILITY MATRICES								
Hazard vs Resources	Cyclone	Flood	Drought	Earth quake	Fire	Storm	Tsunami	**TOTAL**
House	3	3	0	2	3			11
Market	3	3	2	1	2			11
Animals	3	2	2	0	0			7
Garden	3	3	3	2	2			13
Family	2	3	2	1	3			11
Small business	3	2	1	2	3			11
TOTAL (Port Vila)	**17**	**16**	**10**	**8**	**13**			64
House	3		0	2	3	2		10
Garden	3		3	2	3	2		13
Road	2		0	2	3	1		8
Family	0		2	0	3	3		8
Market	2		2	0	3	0		7
Transport	2		0	2	3	0		7
TOTAL (Marobe)	**12**		**7**	**8**	**18**	**8**		53
Garden	3	3	3		3		0	12
Water	2	2	3		3		0	10
House	3	2	0		3		3	11
Livestock	3	2	3		3		2	13
Market	3	1	2		3		3	12
Nakamal	2	1	0		3		2	8
TOTAL (RingRoad)	**16**	**11**	**11**		**18**		**10**	66

SANTO HISTORICAL TIMELINE		
YEAR	EVENT	IMPACT
2016	Tropical Cyclone Lucy	9 house down, banana, manioc, yam destroyed - no food for market or family
2016	Land dispute	Schools close, all food harvested from garden, no more plants
2016	Tropical Cyclone Zena	1 house down; 1 family killed, trad. houses damaged, heavy rain, flooded houses, market closed
2015	El Nino	Affected island taro, kava, Fijian taro and seedlings, big river dries up, 1hr walk for water
2015	Tsunami	Damaged reef and fishery, people had to run to high ground
2014	Landslide	Killed 8
approx 1995	Tsunami	Fish washed up to eat, ppl ran to high ground, roads and tracks blocked,
1982	Earthquake	Rocks blocking road, watertanks fall down,
1981	TC Eric	Severe damage to most houses, crops and garden destroyed
1981	TC Nigel (Naegel)	All food and animals lost, sheep drown, flying fox and fish sick, gov provides food for 4-5 months
1979	Santo rebellion	Damage to housing and property, displacement, stealing
1914	Earthquake	1 dead, ongoing aftershocks for a week, houses destroyed

	Human event (positive)
	Human event (negative)
	Natural event - cyclone

	Natural event - cyclone
	Natural event - drought
	Natural event - earthquake

SANTO VULNERABILITY MATRICES								
Hazard vs Resources	Cyclone	Tsunami	El Nino / drought	Earth quake	Land Dispute	Landslide	Flood	**TOTAL**
Location	3	3	2	3	3			14
Governance	2	3	2	2	3			12
Skills	2	2	2	2	2			10
Natural resources	2	3	3	3	3			14
Market	3	3	0	3	3			12
Infrastructure and tech	3	2	2	2	3			12
TOTAL	**15**	**16**	**11**	**15**	**17**			74
Location	3	0	2			0	0	5
Governance	3	3	3			3	3	15
Skills	2	0	3			0	3	8
Natural resources	3	0	2			0	3	8
Market	3	0	2			0	1	6
Infrastructure and tech	2	0	0			0	3	
TOTAL	**16**	**3**	**12**	**0**	**0**	**3**	**13**	47
Location	1	3	2	3		3		12
Governance	1	1	3	2		1		8
Skills	1	1	1	3		2		8
Natural resources	2	1	2	2		2		9
Market	3	2	3	2		1		11
Infrastructure and tech	3	2	2	2		2		11
TOTAL	**11**	**10**	**13**	**14**	**0**	**11**	**0**	59

UN Women is the UN organization dedicated to gender equality and the empowerment of women. A global champion for women and girls, UN Women was established to accelerate progress on meeting their needs worldwide. UN Women supports UN Member States as they set global standards for achieving gender equality, and works with governments and civil society to design laws, policies, programmes and services needed to implement these standards. It stands behind women's equal participation in all aspects of life, focusing on five priority areas: increasing women's leadership and participation; ending violence against women; engaging women in all aspects of peace and security processes; enhancing women's economic empowerment; and making gender equality central to national development planning and budgeting. UN Women also coordinates and promotes the UN system's work in advancing gender equality.

Fiji Multi-Country Office
Level 3, Kadavu House
Victoria Parade Suva
Tel: +679 330 1178

Vanuatu Office
UN Joint Presence Office, Block 2,
Corner of D'Artois & Rue de Bretagne Street,
Nambatu, Port Vila
Tel: + 678 25910

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