



CLIMATE CHANGE & MARKETS FOR CHANGE PROGRAMMES

BUILDING MARKET RESILIENCE TO CLIMATE CHANGE

SOLOMON ISLANDS ASSESSMENT REPORT
DECEMBER 2016



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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Executive Summary

Honiara and Auki towns in the Solomon Islands have been plagued by devastating disasters in the past: tropical cyclone Namu in 1986, flash flooding in Honiara in 2014 and drought in 2015. Climate change predictions suggest that the intensity and impacts of such events will worsen over time. This research report assesses the extent to which the markets that UN Women supports in Auki and Honiara are vulnerable to climate change.

The study set out to map, document and understand the relative vulnerability of Honiara and Auki municipal markets and their vendors and farmers to climate change and disaster risks. The outcomes are practical measures and policy recommendations that can be implemented by UN Women's Markets for Change (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 (in terms of location, construction and design), their supply and governance systems, and the ability of market vendors themselves to respond to a disaster or adapt to climate change; and clear similarities and differences between the two market locations.

Both markets exhibited a lack of disaster planning: indeed, this was a key driver for this assessment. Both also lack some essential services such as water supply (Honiara and Auki) and electricity (Auki), as well as poor waste management practices and highly vulnerable supply chains and transport routes. The underlying cause of many issues at the marketplaces themselves can be traced back to a governance structure that does not allow for reinvestment in market infrastructure, nor an adequate maintenance regime. Honiara could be said to be more vulnerable than Auki as it faces the considerable additional challenges of current overcrowding at the market and future rapid urbanisation generally, in combination with climate change. It was observed that a great many market vendors have little awareness of the risks that climate change presents for their livelihoods and their families; or a lack of knowledge, resources or ability required to adapt to these risks. Women, too, were seen to suffer additional challenges due to their responsibilities within the home and caring for children in addition to their role as market vendors.

The recommendations made in this report are not simply for the purpose of future climate change adaptation but are 'no regrets' strategies that will benefit Solomon Islands market vendors, women and communities regardless of the extent of future climate change by strengthening food security and income sustainability, and ensuring that the markets remain operational in the wake of disasters. 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 will be repeated at markets in Fiji and Vanuatu.



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). 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. 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). Therefore, adequately addressing the risk of climate change and disasters requires assessing and responding to the needs of various groups within communities. 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). The hours are long, the profits are often low, and conditions are difficult. 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 six-year (2014-2019) multi-country project 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 UN Women Markets

for Change (M4C) project, which operates in Fiji, Solomon Islands and Vanuatu. 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 Vanuatu in 2015, the 2015/16 El Niño southern oscillation and most recently Tropical Cyclone Winston in Fiji in 2016.

Climate change vulnerability assessment is a key instrument to identify, prepare for, and adapt to climate change and disaster risks. It provides information for decision-makers on the extent and magnitude of likely impacts attributable to climate change. It also enables them to identify the most vulnerable geographical areas, sectors, and social groups. In turn this analysis build the foundation for policies, strategies, and actions to prevent or reduce the severity of these impacts, while enhancing the resilience of affected social groups.

Outline

This report summarises the findings of the first phase of an assessment of the vulnerability of local markets which will be undertaken in the Solomon Islands, Fiji and Vanuatu. It studies the two M4C markets in Solomon Islands: Honiara market, located in the capital city and on the island province of Guadalcanal, and Auki market, located on adjacent Malaita island province. 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 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 which depend on them.

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 mission of the Solomon Islands National Climate Change Policy 2012-2017 *“To enhance adaptation, disaster risk reduction and mitigation capacity ... that contributes to increased resilience and achievement of sustainable development goals”*.

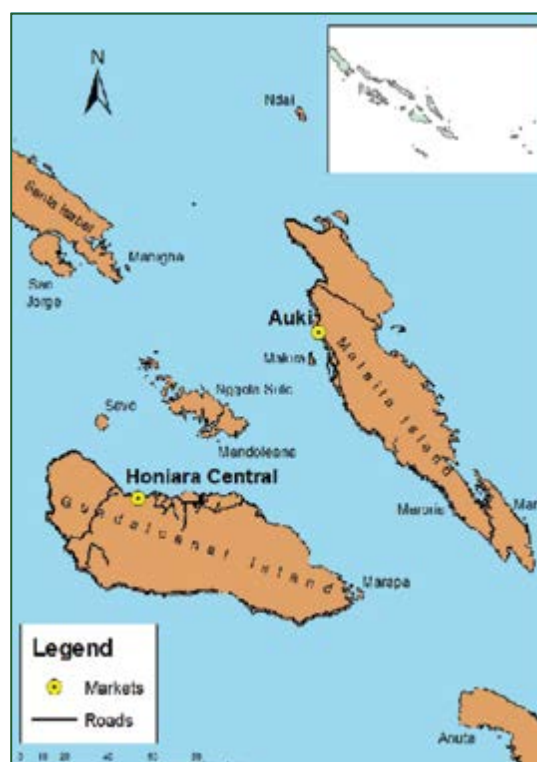


Figure 1: Solomon Island market locations

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 the study 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 within the market trading system
- To identify effective strategies to increase resilience to climate change including climate change 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 scale markets in Vanuatu. This report concerns the two Solomon Islands markets: Honiara and Auki (Figure 1).

Objectives

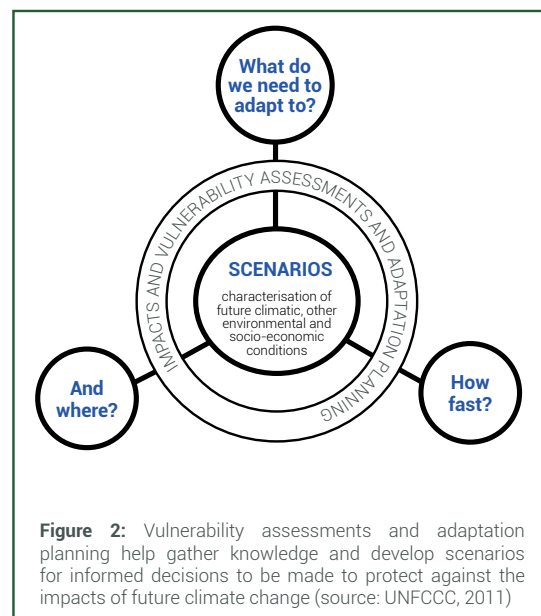
There are three stated objectives:

1. To map, document and understand the vulnerability and relative resilience of Honiara and Auki municipal 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.

The Solomon Islands, Vanuatu and Fiji are all heavily impacted by disasters, many of which are exacerbated by climate change. Those living



in these countries 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 Solomon Islands 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 changes and disasters, to improve the resilience of market vendors' livelihoods.



2. Climate Change Projections for the Solomon Islands

Current climate

Solomon Islands temperatures are relatively constant throughout the year. The country has a 'wet' season from November to April and a 'dry' season from May to October. Rainfall is affected by the movement of the South Pacific Convergence Zone and the Intertropical Convergence Zone. These bands of rainfall influence the wet season which is driven by large differences in temperature between the land and the ocean.

The climate varies from year to year due to the El Niño Southern Oscillation (ENSO). This cycle describes the fluctuations in temperature between the ocean and atmosphere in the east-central Pacific. El Niño periods bring warmer and drier than normal wet season conditions; while La Niña periods are cooler and wetter than normal. This impact is stronger in eastern provinces than in Guadalcanal and Malaita (PCCSP, 2011). These deviations from normal surface temperatures can have large-scale impacts on ocean processes, weather and climate. While the link between El Niño and climate change is not clear, the impacts are not dissimilar and therefore current conditions under El Niño conditions provide an indication of conditions under certain climate change scenarios.

Impacts to Date

CYCLONES

The Solomon Islands has not experienced a disastrous cyclone recently, however, the worst disaster of the twentieth century, and possibly Solomon Islands history, was cyclone Namu on 18-20 May 1986. While only category 2 in intensity, the cyclone was very slow moving and brought heavy rain and flooding. People were unprepared for its impact and communication of the danger was difficult. Namu killed over 100 people, injured over 1,000 and left 90,000 people homeless. Approximately 70% of houses

in Guadalcanal are constructed of traditional materials and therefore more likely to be destroyed in a storm. The tendency of squatters to build inexpensive and illegal temporary structures increased the number of fatalities and continues to cause significant risk to housing during cyclones.

The effects of Namu were significant and long-lasting. It wiped out entire villages on the outer islands, caused major landslides and destroyed bridges which hampered rescue work. In the aftermath, Malaita and Guadalcanal were plagued by diarrhoea, dysentery and malaria (ABC News, 1986). The government reported 53% of gardens completely lost and 26% partially damaged; 22,000ha of coconut plantation destroyed; 35-40% loss of the copra and cocoa production over the following 12 months. Livestock is a very important source of income for households in the Solomon Islands and the loss of animals also had a direct and severe economic impact (Government of Solomon Islands, 1986).

FLASH FLOODING



Figure 3: Severe flooding of the Mataniko River in April 2014

In early April 2014, Guadalcanal again experienced flooding as a result of heavy rain brought on by Tropical Cyclone Ita. Rivers overflowed, sending torrents of brown water through Honiara and villages across Guadalcanal Province (Fig. 3) (UNOCHA, 2014). The large flows and debris buildup caused extensive damage and severe erosion: roads were damaged, bridges destroyed, potholes were created and landslides occurred. Access was cut off in Honiara and in multiple locations in East and West Guadalcanal. The

old bridge over the Mataniko River in Honiara was washed away and subsequently, there was unprecedented congestion at the new bridge, one of the only access routes into the city from the east (Government of Solomon Islands, 2014).

Houses constructed of traditional materials comprised about 49% of the houses that were destroyed. Full rebuild took an average 18 months, while partially damaged houses required an average of 3 months to repair (Government of Solomon Islands, 2014). Three health clinics in Honiara City and three in wider Guadalcanal were also damaged. The most significant agricultural damages were the destruction of cocoa and copra driers and rural road, the loss of livelihood assets such as farming tools and a significant loss of animals, mostly pigs and poultry. There was also damage to fences, chicken sheds, and pig structures. The floods impacted fishing communities living close to main rivers in Honiara City and east and west Guadalcanal: their losses included fishing equipment, canoes and boats; and caused significant damage to food gardens and fruit trees. Cassava, sweet potato, and taro accounted for a majority of the crop losses. (Government of Solomon Islands, 2014).

The subsequent impacts on availability and price of food in Honiara were severe. Most rural residents are dependent on subsistence agriculture and small-scale income generating activities, particularly the export of cash crops, traditional crops, and other fresh products lost their livelihoods for several months. There was a distinct decrease in the availability of fresh vegetables and an increase in their price in the markets. This caused secondary impacts on the food security and nutrition of a large portion of the population in Honiara and other areas of Guadalcanal Province. With lost income and major food access issues, many small farmers struggled to cope with the disaster. Cash for work activities were established for community-level cleaning to enable affected families to meet

food needs and for the promotion of resilient agriculture techniques (Government of Solomon Islands, 2014).

DROUGHT

Following the floods, the drought conditions caused by the 2015/2016 El Niño caused repeated interruptions to crop cultivation and further delayed recovery of the agriculture sector, further reducing food security for all (UNOCHA, 2016).

SEA LEVEL RISE

Despite low population density, the majority of human settlements in Solomon Islands are located in low-lying coastal areas, and reef islands are becoming increasingly densely populated due to limited flat land adjacent to the coast. Inundation severity and frequency has become unacceptable for several communities and relocation has occurred. In Nuatambu village, over 50% of houses have been washed into the ocean as a result of shoreline recession (Albert et al., 2016). While some families have relocated to the high volcanic island of Choiseul, some economically disadvantaged families have re-built temporary housing in increasingly vulnerable areas of Nuatambu. The relocation of the families to Choiseul was not done in a systematic way, resulting in the community unable to remain intact. Instead, the families have moved to areas of land they have tenure claims over. In addition to these village relocations, Taro, the capital of Choiseul Province is set to become the first provincial capital globally to relocate residents and services due to the threat of sea-level rise.

Future Projections and Implications

Under the future conditions of climate change, temperatures in the Solomon Islands will increase. Under a high emissions scenario, this increase in temperature is projected to be in the range of 0.4-1.0°C by 2030 and more than 2.5°C by 2090. The increases in average temperatures

will also result in a rise in the number of very hot days and warm nights. The average rainfall is also predicted to increase throughout the 21st century with extreme rainfall occurring more often, inducing repeats of the 2014 flash flooding event. There will likely be a decrease in the number of tropical cyclones but an increase in the average maximum wind speed and intensity of cyclones (PCCSP, 2011).

The Solomon Islands contain many low-lying reef islands and atolls that are impacted by widespread erosion and inundation, therefore small remote islands and the communities that inhabit them are particularly vulnerable to sea-level rise. Rates of sea-level rise in the Solomon Islands over the past two decades are amongst the highest globally, averaging 3 mm yr⁻¹ since 1950 and 7-10 mm yr⁻¹ since 1994. At least eleven islands across the northern Solomon Islands have either totally disappeared over recent decades or are currently experiencing severe erosion. Sea level is expected to continue to rise in the Solomon Islands and combined with natural year-to-year changes will increase the impact of storm surges and coastal flooding. As in the atmosphere, ocean carbon dioxide

levels are rising in response to increased fossil fuel burning, leading to an increase in acidity of sea waters in the Solomon Islands. Impacts of ocean acidification on the health of reef ecosystems and the people whose livelihoods depend on them will be compounded by coral bleaching, storm damage, and fishing pressure (PCCSP, 2011).

Less frequent but more intense tropical cyclones will result in more damages that will take much longer to repair, and, possibly, lower frequency will result in a population that is less prepared and aware of the risks. These intense cyclones will be more damaging to crops which, as evidenced by the 2014 flooding, will significantly affect the livelihoods of farmers and market vendors in the Solomon Islands, particularly in Honiara and Auki, and cause a distinct decrease in the availability of fresh vegetables and an increase in their price in markets. Many women market vendors and farmers would currently be unable to cope with the lost income and major food access issues of a single disaster of this nature, and considering the prevalence of traditional housing in the Solomon Islands, many more houses would be destroyed by more intense cyclones.



3. Methodology

What is Vulnerability?

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).

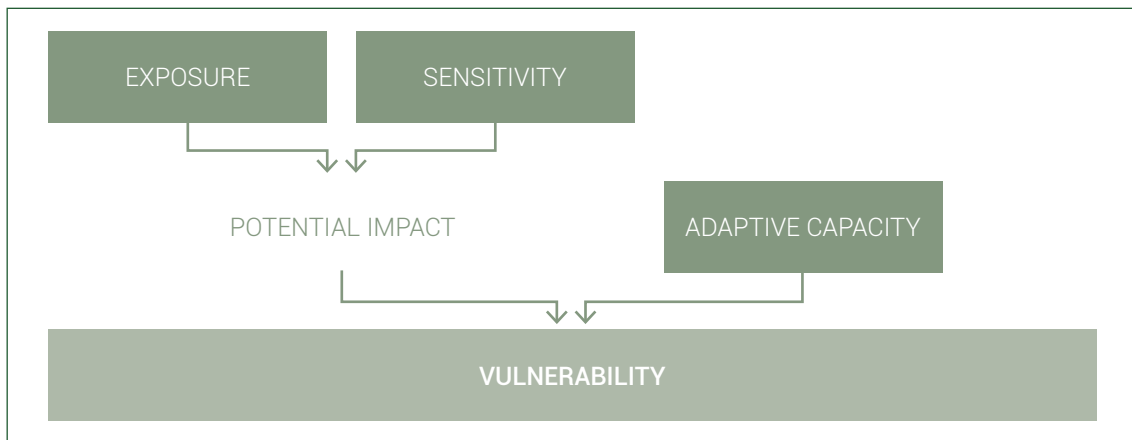


Figure 4: Factors for assessing climate change vulnerability (Source: UNFCCC, 2011; adapted from Allen Consulting, 2005)

Methodological considerations:

Vulnerability assessments do not generally take a single, ready-made method 'off the shelf'. Hinkel et al. (2010) advises that instead, several methods, usually from different research fields, should be combined uniquely for any given case. Therefore, a review of literature and guidance was critical to inform the development of this project's methodology.

The methodology employed for this project is largely based on UNFCCC guidelines and the Nairobi Work Programme of Action. It takes a 'vulnerability and adaptation' approach (Table 1), and is mostly bottom-up, with input from climate data analysis and GIS data analysis. Consideration has been given to the good practice guidelines laid out by UNFCCC (Table 2) to ensure the success of the assessment (UNFCCC, 2011).

Table 1: Existing and emerging approaches to impacts, vulnerability and adaptation assessments and associated methods and tools (source: UNFCCC (2011), adapted from Carter et al., 2007)

APPROACH	KEY FEATURES		
	Motivation	Practical Goals	Underlying Methods
Impact-based	Research-driven	Action to reduce risks	<ul style="list-style-type: none"> - Standard methods following the scenarios → biophysical impact → socio-economic implications sequence - Driver-pressure-state-impact-response' (DPSIR) methods - Hazard-driven risk assessment methods.
Vulnerability	Research-/ stakeholder-driven	Action to reduce vulnerability	<ul style="list-style-type: none"> - Vulnerability indicators and profile - Past and present climate risks - Livelihood analysis
Adaptation-based	Research-/ stakeholder-driven	Action to reduce adaptation	<ul style="list-style-type: none"> - Agent-based methods - Narrative methods - Risk perception including critical thresholds - Development/sustainability policy performance - Relationship of adaptive capacity to sustainable development
Integrated assessment	Research-/ stakeholder-driven	Global climate policy options and their economic implications	<ul style="list-style-type: none"> - Integrated assessment modelling - Cross sectoral interactions - Integration of climate with other drivers - Stakeholder discussions - Linking models across types and scales - Combining assessment approaches/methods
Risk management	Decision making-driven	Robust climate risk management decision	<ul style="list-style-type: none"> - Methods applied under all other approaches - Methods for characterizing and managing uncertainties

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 a 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, reflect many different voices, perceptions and experiences. The synthesis of the results and method for identifying 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) which followed the general approach outlined below is pictured in Figure 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

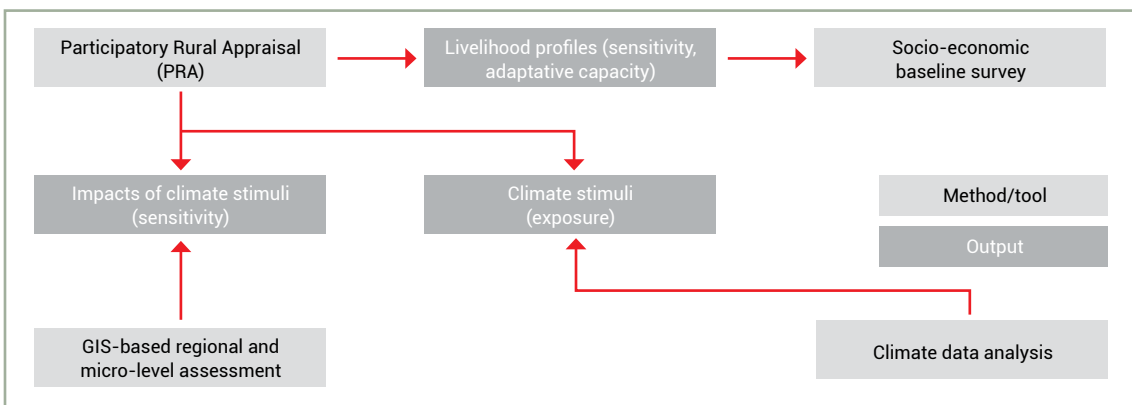


Figure 5: Methodology applied in a local-level vulnerability assessment in three villages in West Bengal

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 the Solomon Islands. 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, Geographic Information Systems (GIS) were used to map 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.

2. Field work:



Figure 6: Auki market assessment

Field work was undertaken over three days in each of the two 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.



Figure 7: One focus group presents their 'seasonal calendar'

The research activity comprised an assessment (Fig. 6) 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 vendors per market, 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. 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, 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 (Fig. 7).

From the focus groups, 4-6 individuals (one per group) were identified for a short, one-on-one semi-structured interview (refer Appendix 2 for structure). This was a more in-depth analysis of personal experiences of climate change and disasters and fears, concerns, knowledge and awareness of the vendors themselves.

3. Analysis:

As explained by Figure 4, 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 what aspects of the market is/are 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 next and 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.



4. Results: Auki Market

Market Assessment

Design and Construction: Overall, Auki market is well-constructed, modern, clean and well-managed, with regular communications to and among vendors. It provides a pleasant, safe, well-ventilated and naturally lit working and shopping environment having moved from its previous location on a dusty, small and uncovered location (Figures 8 and 9). The market is said to be cyclone proof, therefore offering refuge or evacuation point during and in the aftermath of a disaster.



Figure 8: Auki marketplace, built 2011;



Figure 9: Old market site

There are some poor design elements which have failed to take account of the Solomon Islands context or the market vendor's needs. For example, it is said that sun damage has caused the leaks in the fiberglass water tank. At the time of the assessment the butchery, cool room, fish sales area, rubbish storage room and toilets were not operational due to being deemed unsuitable or lacking power/water supply. The effective and long term future operation of the market is very much dependent on a robust maintenance regime to address these problems.



Figure 10: Location and approximate extent of Auki market site

Location: The market is located on the coastline and within 100m of a river system (Fig. 10) – the proximity of river and sea are both risk factors in the context of climate change due to the risks of erosion, storm surge, king tides, sea level rise and heavy and unpredictable rainfall. However, the coast is strengthened against such threats by a sea wall and the river, by gabion baskets. The market has an adequate setback distance from both sea and river and in addition, Auki is located in a relatively sheltered bay. These factors mitigate risk. Although the location is relatively new and yet to be tested in an extreme event, with appropriate management the location is thought suitable to cope with future climate change. There is some evidence of erosion of the gabions, which should be a part of the maintenance regime mentioned above.

Governance and Maintenance: The markets are overseen by the town councils. One of the key observations in relation to risk relates to governance and management, in particular, maintenance work and budget planning. While the revenue collected daily from the market vendors (S\$10-20/day) is significant, this is passed immediately on to the council with no avenue for immediate redistribution of funds back into the market. This means that emergency repair work and preventative maintenance work, as recommended by the contractor upon completion of construction (Fig. 11), has suffered. Examples of this are:

1. toilets are permanently closed as water reticulation system needs repairing.
2. butchery and cool room are unused as there is no longer electricity running onsite
3. the market has a rainwater harvesting system with underground rainwater tanks. However, these are unusable as the electric pump is in need of repair, with pump maintenance long neglected);
4. the fiberglass water tank fed by the electric pump is said to be leaking;
5. the lack of cyclical maintenance has led to regularly blocked drains which in turn create odour and health issues. In particular the fish vendors have relocated to a more suitable location that drains to ground (but creates muddy conditions and potentially erosion). The market needs a daily hosedown. The Market Manager once employed a drain cleaner for this purpose who resigned and was not replaced.

While the market manager does an excellent job under these circumstances, with no mechanism for reinvestment and redistribution of some of the revenue funds, maintenance and improvement work is slow and difficult and furthermore, no emergency funds are available for immediate repairs or disaster response. Design considerations are closely tied to maintenance issues. As mentioned under Design and Construction (above), many intended features of the market are non-operational. Continued effective operation of the market is dependent on a robust maintenance regime that addresses these problems.

Partial redistribution of market revenue to a fund for maintenance and improvement works, and /or recruitment of a dedicated maintenance officer would address a number of these issues named above, which currently flow on to affect operation of the market and increase risk overall. A Market Vendors Association (MVA) has been set up which offers the potential for better consultation and more transparent decision making, and the opportunity for market vendors to work together as a collective to improve the market environment and systems. For example, the MVA offers a small loan facility for use by vendors.

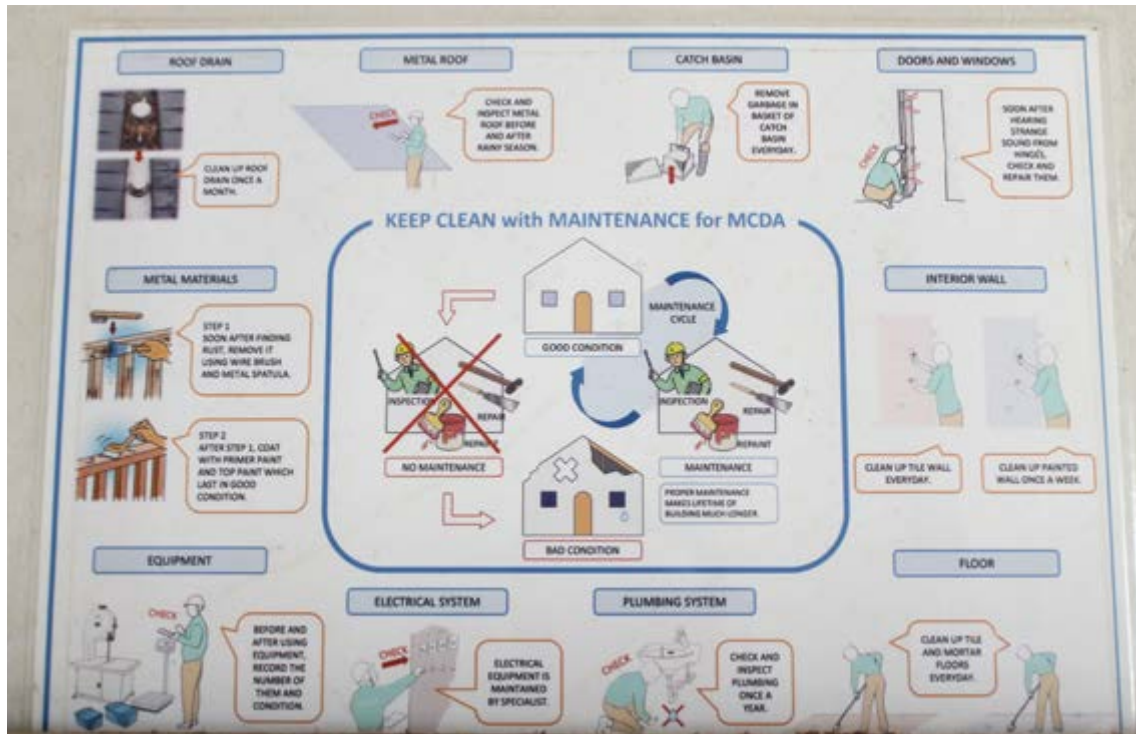


Figure 11: Clear instructions were provided at construction for maintenance regime of Auki market

Facilities and Services: Of concern, the market not only lacks secondary sources of water and power, but the primary supply also needs to be reestablished. Poor funding and lack of maintenance has resulted in disconnection of the mains power supply, the back-up generator being stolen, leaks in the water tank, and a broken electric pump to feed this tank. Of course both factors heavily affect the market's proposed use as an evacuation point for the community. Simple lack of water is leading to a lot of dysfunction in the market.

While the market was designed and built with a designated storage area for rubbish (Figure 12), waste is currently stored in a pile outside, generating odour, health risk and environmental risk, particularly in the event of flooding (Figure 13). It is understood that a waste management plan is under development to alleviate the situation. It is recommended that the waste be relocated to the designated storage location as

soon as bins/skips have been procured for this area. Fortunately, waste is predominantly organic and therefore can be sorted for composting. In fact, some green waste is sent to the local rural training centre where it is fed to pigs or made into compost. The market cleaners have been sent on a field trip to the composting facility to raise their awareness. Organic and inorganic waste removal has high costs therefore alternatives are to be investigated such as purchase of a truck and trailer or composting onsite.



Figure 12: Auki waste storage;



Figure 13: Designated waste storage shed

Transport: When considering climate change and disaster scenarios, transport, accessibility and functioning of the market are also high risk factors: road infrastructure is poor and highly vulnerable to disaster which can cut off large

parts of Malaita from the market for weeks following heavy rain, cyclone or landslide. In addition, land disputes have resulted in a smaller than planned site area, therefore the parking, loading and unloading area is cramped.

Section 11 of this report summarises the recommendations arising from these observations. The completed summary market assessment checklist for Auki market is included as Appendix 3. The below matrix (Table 3) assigns risk ratings from 0 (no risk) to 3 (high risk) to each area of assessment under different scenarios to prioritise areas for improvement. Three are highlighted for priority action: governance/finance, transport and waste.

Table 3: AUKI MARKET ASSESSMENT					
	Cyclone	Drought	Flooding	Tsunami	TOTAL
Main building	1	0	2	2	5
Associated infrastructure	1	0	2	2	5
Produce sold	2	3	2	0	7
Governance and finance	3	2	2	3	10
Waterways	2	0	2	2	6
Disaster planning	2	1	2	2	7
Energy security	2	0	0	1	3
Water security	2	3	1	2	8
Accessibility	1	0	1	0	2
Transport	3	1	3	3	10
Drainage	3	0	3	2	8
Waste management	3	1	3	3	10
	25	11	23	22	

Focus Groups

Focus group discussion formed the second part of the agreed methodology. In all, seventeen participants formed the focus groups: 11 female and 6 male. Objectives were to develop a seasonal calendar, historical timeline and vulnerability matrix for Auki market. They are discussed in sequence below.

The group concluded that a particularly stressful time of year for Auki market staff, vendors and farmers is November to February. During

this time, natural hazards are more prevalent, households face additional costs and lower incomes, weather is poor and some crops are unavailable, plus there seemed to be some correlation with disease outbreak.

In examining historical risks and impacts in the historical timeline exercise, the focus groups identified many events over a long history (since 1925). Some natural, some non-natural; some positive, some negative. In recent history, the biggest social risks come from political tension and disease outbreaks; environmental

risks were cyclones, flooding, drought and earthquake/tsunami. A severe cyclone has not been experienced since 1986, but flooding and political tension are particularly recent impacts.

In assessing vulnerability, the highest ranked hazards were broadly spread across cyclone, tsunami, flood and sea level rise, all of which are of course exacerbated or caused by climate change. All of these hazards featured in both the historical timeline and vulnerability matrix also. Drought was secondary to these because its slow onset means that preparations are possible (though not necessarily undertaken in the past). In regards to most at-risk resources, aspects related to the market itself and home gardens were rated most high risk/most highly affected. Interventions should focus on minimising closures of the market in the event of a disaster, and enhancement/ protection of gardens.

Interviews

Six personal interviews were undertaken in Auki: three participants were female and three, male. The interviews were an excellent source of first-hand information on historical and current climate change and its impact on the lives of the market vendors as a qualitative measure of exposure and sensitivity. It was also a way to gauge levels of worry and stress experienced by the market vendors, and in particular women that were not otherwise measured or recorded. Findings from the interviews are described below in the context of exposure, sensitivity and adaptive capacity, as indicators of overall vulnerability. Questions to test awareness of and response to climate change provided a good indication of relative adaptive capacity.

EXPOSURE: Cyclone Namu's impact in 1986 was very significant for the residents of Malaita and is still talked about today. The source of most stress and worry is the possibility of another cyclone like Namu in the near future. Other historical events that evidence how climate change

impacts Malaita are recent flood and drought. Generally, the change to weather observed most by the participants was unpredictability and deviation from normal seasons and patterns which made it hard to plan ahead and maximise crop yield. Market gardeners suffer a lot from seasonality which makes certain times of the year very difficult for feeding their family and generating income. Some have diversified to other commodities to cope. The period from January to March was often said to be hardest, which agreed with the outcomes of the seasonal calendar exercise. Those with no alternative income make efforts to save in good times to cover these periods, but only a few bank these savings. All of these factors contribute to a high level of exposure for Auki market and Auki market vendors. It is notable that most Auki market vendors grow their own produce, in contrast with Honiara market which has large numbers of Honiara-based middlemen who buy produce from farmers and gardeners to sell on.

SENSITIVITY: At the time of cyclone Namu, most of the population lived in traditional houses made of leaves, palm fronds and bamboo, therefore most houses were completely destroyed along with gardens. Concrete and permanent houses fared much better and since then some vendors have upgraded their accommodation but large numbers still live in temporary housing.

Climate change and disasters are not the only risk factors for the market vendors. Social factors such as land dispute and insecure water supply are also very significant. In a small town such as Auki there are less opportunities for diversifying or developing alternative livelihoods than in a city such as Honiara. These factors increase the level of sensitivity of Auki market to climate change. Women market vendors can also experience heightened sensitivity and spoke of high stress during disasters due to additional household and family responsibilities. Other factors reduce sensitivity: most interviewees said that they felt able to gather information to enable

them to prepare for, respond to and recover from disasters from a range of sources, despite the fact that access to technology is limited, and the tight community and church structures assist with this. Overall the sensitivity for Auki is moderate.

ADAPTIVE CAPACITY: Risk factors relating to adaptive capacity were an observed lack of knowledge of heightened risk or how to respond, or general lack of appreciation of the importance of preparedness to disasters, with many stating they would simply take shelter indoors.

A very strong spirit of community was very evident in Auki and is characteristic of the Solomon Islands. This in itself is one of the single most valuable coping strategies available to those affected by disasters. The church also provides a very strong support network. The community prepares for a cyclone together, will

share surviving crops and rebuilds together. Other coping mechanisms discussed included seed banking, use of palm leaves of the coconut tree to strengthen the roofs of traditional housing and taking shelter in the strongest available house, and sharing of traditional knowledge of food preservation techniques and of particularly disaster resistance 'emergency' sources of food such as swamp taro and native leafy greens.

VULNERABILITY: Together, the findings from the market assessment, focus groups and interviews contribute to relative, qualitative measures of exposure, sensitivity and adaptive capacity and therefore vulnerability of Auki market as a whole to the range of expected climate changes. More importantly, it enables the development of recommendations for reducing this vulnerability over time. The overall vulnerability of Auki market is discussed in further detail in Section 7. Recommendations are outlined in Section 8.



5. Results: Honiara Market

Market Assessment

Design and Construction: Despite its position on a coastal floodplain, Honiara market is well designed to withstand a cyclone, tsunami or flood. It is well-built with water storage, drainage and a generator onsite; however, years without investment and maintenance have significantly affected the effectiveness of its operation. Many facilities no longer work, including the water supply and the backup generator. Also, the market was built to house far less vendors than it does, even on the quieter days of Tuesday and Wednesday. Many vendors now sell outside the main market structure and therefore are exposed to weather extremes. Clothing vendors are affected by rain which makes their clothes unsellable and fish vendors are exposed to the sun and very high temperatures. Fish are therefore kept in covered plastic bins rather than on display, but still suffer the effect of the sun and unhygienic conditions.

Location: Honiara market is set in a vulnerable location in terms of both accessibility and environmental factors. A single and extremely busy coastal main city street runs east-west along a narrow alluvial plain and it is from here that the market is accessed and goods are supplied. The market site is sandwiched between this busy road and the sea (Fig. 14). There is no slip road and the market causes much congestion and major traffic problems that at peak times affect all of Honiara city centre. In times of disaster this would hamper evacuation, rescue and recovery operations. Furthermore, access to the city from most directions is reliant on poorly maintained bridges across the Mataniko and White Rivers, which if damaged, effectively cut off not only the market vendors and customers but the entire city from the rest of Guadalcanal. The steep land surrounding Honiara centre makes access to and from the interior difficult and increases the risk of landslide, flash flood and earthquake damage (HCC TWC, 2013).



Figure 14: Layout map of Honiara market

Governance and Maintenance: Honiara market is run by Honiara City Council (HCC). As was the case in Auki, revenue collected from market vendors by the market manager is sent directly to HCC and there is no mechanism for direct reinvestment into the market. Unfortunately, this means that the market has fallen into disrepair despite the best efforts of market vendors, staff and management. There are severe concerns in particular over security. The market is left open at night where drinking and crime is common and anything of value, including market equipment is quickly stolen. Plans already exist for a new perimeter fence and this will have an immediate positive impact on safety and enable other improvements to follow: the market will be able to close as per its advertised hours so that cleaning and maintenance can take place, and investment in equipment and infrastructure will be possible. Like Auki, Honiara market has a relatively recently formed Market Vendors Association, which offers potential for better engagement and collaboration with market vendors in the future.

Facilities and Services: Although Honiara market was built with a rainwater harvesting system and several large metal water tanks (Fig. 14), the system is not operational and there is no water supply for the market vendors. Some resort to using polluted water directly from the sea, and not far from untreated city discharge, for washing fish for example. Although the city now uses borewater from underground aquifers, the market does not use mains water supply, nor take advantage of the aquifer. The market has electricity sourced from mains but no alternative is available currently (Fig. 15). Honiara, and the Solomon Islands generally is completely reliant on imported and expensive diesel fuel for generation of electricity, a significant vulnerability factor. In fact, Solomon Islands have some of the highest electricity commodity prices in the world (Rodil, 2014), and while the Electricity Authority is able to meet peak load of Honiara

City, there is no reserve capacity. If a generator fails, load shedding causes blackouts throughout the city. Solomon Islands is currently looking into hydropower but this is a long way off. The market itself has a backup generator that does not work. With fencing and security in place, the backup generator will be able to be repaired and safely stored.



Figure 15, 16, 17: Disused rainwater tanks; disused electricity generator; blocked drainage system

Severe overcrowding of Honiara market is causing a lot of pressure on the current space and infrastructure. The assessment team discussed the possibility of establishment of satellite markets to the west and east of Honiara CBD. This may be successful in taking some pressure off the market vendors who travel a long way and are often relegated to positions outside the market gates, as well as pressure on services, resources and space and would lessen congestion and ensure that in times of disaster some markets remain operational for some market vendors to continue earning an income, not to mention the more secure provision of fresh food for the community.

Due to the overcrowded nature of Honiara market, a lot of (mostly organic) waste is generated and

this also blocks the poorly maintained drains (Fig 16). The market floods in times of heavy rainfall because water cannot discharge and instead pools inside. This volume of waste must be removed from the city everyday but delays of several days are common. An affordable system is needed whereby waste can be promptly and regularly removed from site, to minimise risk to health and problems in a disaster.

Section 11 of this report summarises the recommendations arising from these observations. The completed market assessment checklist for Auki is included as Appendix 4. Table 4 assigns risk ratings from 0 (no risk) to 3 (high risk) to each area of assessment under different scenarios to prioritise areas for improvement.

Table 4: HONIARA MARKET ASSESSMENT					
	Cyclone	Drought	Flooding	Tsunami	TOTAL
Main building	1	0	2	3	6
Associated infrastructure	1	1	1	2	5
Produce sold	3	3	1	1	7
Governance and finance	2	1	2	2	7
Waterways	3	0	3	2	7
Disaster planning	3	1	2	2	8
Energy	2	0	0	1	3
Water	2	3	2	2	9
Accessibility	2	0	3	2	7
Transport	2	0	2	1	5
Drainage	2	2	3	2	9
Waste management	2	1	3	2	8
	25	12	24	22	

Focus Groups

Sixteen participants attended the Honiara focus groups: Thirteen female and three male. Again, the three exercises (seasonal calendar, historical timeline and vulnerability matrix) were undertaken in small groups of four. Each exercise is summarised in sequence.

While Honiara is exposed at all times of year to most hazards, it was observed that, as in Auki, between the months of November and February,

vulnerabilities increase as a result of many contributing factors relating to weather (cyclone/flood likelihood), cash flow (school fees and other costs, lower sales/income, holidays), food and crop availability (some fruit and vegetables not ready for harvest). Authorities need to be aware that hazards that occur during this time will have a more severe and longer lasting impact. Immediately prior to this period would be the best time for an awareness drive.

Significant differences were observed in Honiara in comparison with Auki in regards to the type of historical events that most impacted people's lives. Most of these differences could be attributed to the urban setting of Honiara versus the relatively rural Auki. In Honiara, the political and economic environment has a huge impact of the lives of Honiara residents. Events such as ethnic tension, land disputes and riots and disorder associated with elections were noted by all of the focus groups, and particularly by women, presumably due to safety and security concerns, and limited access to basic necessities such as food for the family. Events relating to overcrowding such as disease outbreak were also significant. Honiara residents were also less likely to celebrate positive events than Auki residents, probably this is related to the more close-knit nature of a rural community. Regarding natural hazards, the risk of a repeat of the 2014 flash flooding is feared by many, but cyclones were not perceived as as great a threat in Honiara, presumably because 1986 is a distant memory and because urban dwellers have permanent houses, access to stores to purchase food or to government/aid support in contrast to those in Auki. The experience of a cyclone is much more frightening in a village as evidenced by the prominence of cyclone Namu within the Auki focus groups and the stories from the women there.

When ranking hazards, Honiara market was considered most vulnerable to flooding, followed by cyclones. While a cyclone has the potential to affect a much wider area, Honiara market vendors are much more familiar with the impacts of a flood after the events of 2014, and the market's location on the floodplain of the Mataniko River heightens its vulnerability to this hazard. Drought and political tension were also ranked quite highly. When considering the resources most at risk to climate change in the urban environment of Honiara, there was noticed to be more focus on physical/economic

resources such as houses, services and the market than on natural resources such as crops and fisheries as was the case in Auki.

Interviews

Again, in Honiara, interviews provided excellent first-hand accounts of climate change risk and insight into the types of impacts experienced to date. Two men and four women were interviewed. They were influential in assessing level of awareness and understanding of climate change risk and disaster response, and therefore quantifying adaptive capacity.

EXPOSURE: The overcrowded, low lying coastal location of the market and its poor accessibility by a single road means that many people are highly exposed to the next disaster to befall Honiara. Multiple or alternative market sites would spread the risk over a wider area and offer a coping mechanism should the main market be forced to close. Some of the vendors do not have a roof over their stall and therefore cannot market their goods, or risk having goods damaged in severe weather. The urban setting of Honiara protects the market vendors from the full impact of some climate changes but on the other hand heightens the more direct threat of personal impacts as a result of political tension or upheaval, or loss of law and order in the city which is known to happen during stressful times.

SENSITIVITY: The urban lifestyle of many Honiara market vendors makes them sensitive to certain climate change risks such as disease, reliance on purchased goods, and likewise, reliance on daily cash income, and risk of flow-on social problems associated with a populated area such as looting, crime and disease and insecure food, water and energy sources. At the market, the variability of sales mentioned by some, whether from day to day or season to season, also contributes to sensitivity and therefore vulnerability. The lack of security and prevalence of crime, the lack of maintenance, including lack of a primary water

supply or secondary electricity supply, blocked drainage and tendency of rubbish to build up very quickly at the market are all observed by both men and women to be major risk factors. On the other hand, rural residents such most of Auki's market vendors, are at great risk of losing both their own assets and their livelihood in a disaster. It cannot be concluded that either rural or urban populations are more vulnerable to disasters, but actions and recommendations must take into account the different risks faced in each case (Cutter et al., 2016).

ADAPTIVE CAPACITY: Initial assessment of exposure and sensitivity show high vulnerability of the Honiara market system to climate change and disasters. The interviews also served to assess people's adaptive capacity to climate change. Generally, there seemed to be a poor level of knowledge of what to do in a cyclone or flood, and a complacent and reactionary response. All interviewees stated that they would rely on the radio for information in case of disaster (whether or not they owned one), and very little awareness of how to prepare or respond was evident. However, in Honiara some of the women market vendors in particular were obviously skilled, well-educated and more entrepreneurial and had a secondary income or were able to identify alternative livelihoods in the case of temporary market closure. Perhaps this is a result of many unplanned and unforeseen market closures for various climate or political reasons over the years.

VULNERABILITY: Together, the findings from the market assessment, focus groups and interviews contribute to relative measures of exposure, sensitivity and adaptive capacity and therefore vulnerability of Honiara market as a whole to climate change. It enables the development of recommendations for reducing this vulnerability over time. Table 4 shows particular areas of high vulnerability to climate change risks identified from the research, for priority action. These are water supply and drainage, closely followed by waste management and disaster risk reduction - this includes the plans for preparing for and responding to natural hazards. In this case, tropical cyclone identifies as the highest risk, particularly the very real risk and lack of preparation for a repeat event of cyclone Namu, which was a category two cyclone and yet caused many fatalities, particularly of women and children, and extensive and serious damage. This risk is closely followed by the related issue of flash flooding, given the proximity of the Mataniko River and the lessons of 2014. It is worth remembering that the 2014 floods were triggered by a cyclone. As mentioned in earlier sections, women are more at risk during a disaster due to preexisting inequalities. As the majority of market vendors are women, this gender inequality must be taken into account as a disproportionate risk factor and a potential barrier to the implementation of adaptation measures. The vulnerability profile for Honiara market is discussed in further detail in Section 7. Recommendations are outlined in Section 8



6. Discussion: Vulnerability Profiles

The final step in the vulnerability assessment process is to combine the findings about exposure, sensitivity and adaptability to determine how and where the market system and community is most vulnerable to climate change (Table 5). The recommendations and the disaster management plans must primarily

aim to address these areas in order to enhance resilience. They must also take the differences associated with the urban setting of Honiara and in particular the overcrowding and political threats in this location, in comparison with Auki, into account.

Exposure	Auki	Hon	Sensitivity	Auki	Hon	Adaptive capacity	Auki	Hon
Coast location	M	M	Natural resources (crops)	H	H	Governance	H	H
Coastal protection	M	L	Market construction	L	L	Financial resources	M	H
Waterway proximity	M	M	Security	M	H	Knowledge / awareness	M	M
Waterway protection	M	H	Energy source	M	M	Infrastructure/ technology	M	H
Flood plain	M	H	Water source	H	H	Preparedness		
Ground/soil type	L	L	Vendor literacy	M	M			
Wind risk	L	M	Accessibility	L	H			
Tsunami risk	M	H						

Vulnerability Considerations for Auki Market

Exposure: While Auki's geographic location does mean that the community is exposed to some form of climate hazard, whether it be drought, flood or cyclone, at any given time of year, Auki market itself is thought to be fairly resilient to climate change. While it is coastal, the sea wall, riverbank strengthening and sheltered bay should protect the market from storm surge, king tide and rising sea level. Such features have yet to be tested by an extreme event such as a category 4 or 5 cyclone.

Sensitivity: Historically Auki has shown sensitivity to a variety of hazards, both natural and economic/political. Auki market system exhibits high sensitivity to climate change and disasters due to limited variety of crop types and species, high crop seasonality, simple gardening practices, a single, poorly maintained road and long journey

for market vendors from more remote parts of Malaita and small household gardens that lack protection from damage and show a current lack of tolerance to even minor climate change. Even without taking climate change into account, past experiences show existing vulnerability to natural hazards is high: some of the land that is farmed is marginal at best, and the prolonged dry periods experienced recently cause reduced yield and recent flood events destroyed crops. Therefore, any improvement measures that are implemented such as reestablished water systems, provided they are well-planned, will be 'no-regret' strategies (i.e. they will benefit the market vendors and the community regardless of the extent of climate change or the occurrence of natural hazards).

Adaptive Capacity: Adaptive capacity can also be described as low, due to a number of factors. The ineffective governance framework and the limited ability of market manager and

market vendors to cope with problems due to lack of resources or poor access to resources is one such factor. Market vendors have poor access to agricultural knowledge relating to crop productivity methods and products and technologies such as fertiliser and pesticide. The lack of recent experience of tropical cyclone, while fortunate, leads to observed reduced levels of awareness and preparedness in Auki community, inadequate planning for a future cyclone, no early warning system and slow or inadequate response to reports of an impending cyclone when warning is received, or failure to recognise the danger altogether. The Market Vendors Association (MVA) could play a pivotal role in building adaptive capacity through education of better farming methods and response to hazards, communication of risk, implementation of an early warning system and support to market vendors through and following a disaster.

Some adaptive capacity was identified. Coping mechanisms mentioned by some participants included preparing for a disaster such as a cyclone by storing seeds safely, preserving foods, using coconut leaves to strengthen the roof and taking shelter in the strongest house or church. Recovery is assisted by community and church coordination, sharing of surviving crops, rebuilding together and knowledge of traditional and unaffected food sources such as swamp taro and other hardy leafy greens.

Vulnerability: Vulnerability is a function of all of the above factors. With regard to Auki market we can say that while the Solomon Islands and the province of Malaita are highly exposed to climate change and disasters, the market itself is not highly exposed. Rather, the high vulnerability to climate change of Auki market is largely due to sensitivity of the market system and its limited capacity to adapt quickly to climate change or respond quickly to a natural hazard. Particular risk factors are sensitivity of crops (the vulnerability matrix developed by the

focus groups showed that the most valuable resource (crops and gardens) to be at high risk to most natural hazards); shortage of water; and poor governance framework (lack of market maintenance and access to financial resources; planning and preparedness). Vulnerability arising due to market vendors' reliance, particularly in Auki, on a natural resource base (crops, fish, etc.) which is highly at risk to climate change can be reduced by introducing alternative livelihoods and options for adapting out of agriculture to more diverse sources of income, along with appropriate skills training.

Vulnerability Considerations for Honiara Market

Exposure: Honiara market, and indeed Honiara itself, exhibits higher exposure than Auki, due to its location on the Mataniko flood plain and the impact that recent events have had. It is located on the coastline and close to a river that is known to flood during periods of heavy rainfall that the Solomon Islands is already known to experience, affecting both market operation and access routes from villages. It is largely reliant on one road and two bridges to the east and west for access and therefore plagued by constant congestion which makes moving within the town difficult most of the time, and evacuation almost impossible. In addition, the area is susceptible to other social and political problems which compound vulnerability to climate change and disasters.

Sensitivity: Again, Honiara market exhibits slightly higher sensitivity to climate change than Auki, most of which can be attributed to its urban setting. For example, Honiara market area is overcrowded with no adjacent land available for expansion, and land availability problems throughout Guadalcanal, including for the market vendors themselves. Security is very poor: the market is unsafe at night, particularly for women which make up the majority of market vendors, crime and stealing of market resources

is prevalent and contributes to the poor condition of the facilities and lack of water and other services. Urbanisation also tends to undermine traditional structures (Rohil, 2014), though there were indications that strong social networks still exist in Honiara.

Adaptive Capacity: Similar to Auki market, Honiara market's adaptive capacity is severely reduced by the poor governance structure and poor access to resources which has led to long lapses in maintenance, facilities in need for repair, absence of water and shortage of electricity. The interviews showed some market vendors to have great agricultural and traditional knowledge, but little awareness of climate change risk or preparedness measures taken. There is a disconnect between farming and vending in the Honiara case due to high numbers of middlemen operating at the market. No real advantage or disadvantage was notable in terms of resilience: while many Honiara market vendors were able to have a secondary income or were able to swap quickly between commodities, the more rural Auki vendors are able to rely on subsistence agriculture for food security in the event of a disaster. Financial support and resources were said to be available but are difficult for most vendors and in particular for women to access. Some Honiara vendors have savings and make profit but many others are living from day to day. The coping mechanisms available to Honiara residents are limited: some stated that in a disaster they would shelter at home, or at higher ground and await assistance, although the same community support was evident particularly for the more vulnerable members of society. Those that are lucky enough to have gardens or farms were knowledgeable of many strategies for more resilient agriculture including growing more resilient crops (cabbage, pawpaw, banana and a quick growing potato variety) and replanting on the same day as the harvest to ensure constant

supply. Preparedness techniques included use of leaves to strengthen the roof of houses, seed banking to ensure quick reestablishment of gardens, reliance on the 'ngali' nut tree (emergency food source) and coconut oil (emergency fuel) in times of hardship.

Vulnerability: this research has shown that high exposure, high sensitivity and lack of adaptive capacity contribute to high overall vulnerability of Honiara market to climate change. The factors of most influence are its low lying location between the Mataniko and White Rivers, lack of space and accessibility problems, crime levels and security problems and, again, the governance structure of the market that limits the ability to invest directly in the market and to quickly adapt to changing conditions in response to disaster or to support market vendors in times of need.

Limitations

The methodology employed for this study successfully assessed exposure, sensitivity and adaptive capacity at the two locations. It also enabled clear recommendations to be made to reduce risk in future, and to ensure that plans can be made to better prepare for and respond to climate change (Section 8). However, 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. Therefore, the vulnerability assessment ought to be reviewed, plans updated and changes implemented over time through adaptive management. Also of note, the findings are somewhat representative of the time of year the research is undertaken, the year and the participants involved. 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 next step to ensure that the findings of this study are beneficial to market vendors is to continue with disaster preparedness and management planning to strengthen the capacity to adapt and respond. The findings must be aligned with national, provincial and local planning instruments such as the proposed National Disaster Risk Management Plan (once released), and the Auki Strategic Plan, and be widely communicated, in particular to all stakeholders and participants of the study to

ensure relevance, uptake and success of the recommendations. It is important that lessons are learnt from the design shortcomings of both 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.



7. Recommendations

Auki Market		
AUKI MARKET	Short-term	Medium term
Market Infrastructure	<ul style="list-style-type: none"> Once water supply is reinstated, purchase new water infrastructure (hosepipe, hoses and water blaster) for efficient cleaning and maintenance of the market and relocate fish sales back to original location Relocate rubbish pile to storage shed and segregate into organic/ non organic bins to reduce smell, health risk and environmental risk of storage outside on ground Improve fencing around market for security purposes and to protect infrastructure investments 	<ul style="list-style-type: none"> Explore the funding and implementation options for solar power which would make use of the large roof and high sunshine hours, reduce electricity costs, offer a backup power supply and strengthen market building for use as evacuation centre To reduce costs of rubbish removal from site, purchase a trailer for daily carting of rubbish or a compost bin for making fertiliser that can be used by market vendors Improve accessibility of toilets for use by people living with disability
Market Governance	<ul style="list-style-type: none"> Establish maintenance budget for market direct from market revenue to be managed by market manager and appoint maintenance manager who has clear responsibilities for clearing drains, hosing down market and fixing electrical and building faults and wear and tear. Reinstating water and electricity, and the actions listed above, should be priority tasks for this individual 	<ul style="list-style-type: none"> Explore the potential to further develop the MVA loan facility for use for disaster risk reduction (e.g. diversification, crop productivity, non-agricultural livelihoods) and disaster response (e.g. seeds)
Disaster Risk Reduction	<ul style="list-style-type: none"> Draft and finalise, with full stakeholder input and review, and awareness and communication strategy, an Auki Market Disaster Risk Management Plan. This plan should focus on cyclone/ flood and market/garden as the highest priorities identified in the vulnerability profile, and follow the recommendations of the government disaster plan once released 	<ul style="list-style-type: none"> Train stakeholders and market vendors to improve their knowledge of how to know a disaster is approaching and what to do in a disaster to preserve their livelihoods and savings Make use of radio and text message services, (as were found to be most effective) for further development of an early warning system that reaches a large population
Disaster Preparedness	<ul style="list-style-type: none"> Establish food and seed bank in a secure place to assist immediate recovery of the market and market vendors' livelihoods following a disaster 	<ul style="list-style-type: none"> Facilitate access to markets from outlying areas and other villages when hampered or impossible due to damaged roads following bad weather

Capacity Development	<ul style="list-style-type: none"> • Continue to build knowledge and skills of agricultural adaptation strategies such as crop selection, productivity and diversification, taking account of the traditional knowledge identified during the interview process • 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 per vulnerability profile • Raise awareness of strategies for protection and preserving food e.g. smoking fish (Malaita), preserving breadfruit (Temotu). Videos and awareness information are available from NDMO. 	<ul style="list-style-type: none"> • Support diversification of livelihoods, including non-agricultural livelihoods and train women in non-agricultural skills • Upskill market vendors on the above suggested concepts if implemented: composting/waste management, solar power
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Honiara Market		
HONIARA MARKET	Short-term	Medium term
Market Infrastructure	<ul style="list-style-type: none"> • Replace security fencing and boom gate as a priority before other improvements can be made (in progress) so that access can be controlled, safety is improved at the market and operating hours can be reinstated • Implement existing plan for rainwater tanks, with careful consideration first of the viability of a borehole on site for direct access to potable water • Examine the best market layout for facilitating access to and conservation of water within the market, the necessity of awareness materials for water conservation and responsible use, and the need for investment in associated equipment needs and cleaning responsibilities. 	<ul style="list-style-type: none"> • Explore the practicality and viability of solar power which would make use of the large roof and high sunshine hours, reduce electricity costs, offer a backup power supply and strengthen market building for use as evacuation centre • Repair cool store so that it can be used to keep food fresher for longer and as a storage location of emergency foods and other supplies

Market Governance	<ul style="list-style-type: none"> Establish a maintenance budget with particular attention to drain clearance to improve cleanliness, reduce health risks and minimise flooding in tropical cyclones or heavy rain events Review cleaner's roles and responsibilities to improve waste management practices. Consider more cleaners, women cleaners, designated jobs or areas, supervision or privatisation, incentives, indicators or overtime payment, and use of the market's own truck to remove rubbish Review market layout with a long term view, taking particular care to consider new water points, health aspects, rain/sun protection and access to the loading/unloading area 	<ul style="list-style-type: none"> Investigate further the future possibility of satellite markets for relocation of some vendors to relieve pressure on Honiara market and Honiara's transport system, to improve conditions for market vendors, and to ensure that at times of unforeseen or planned closure, market vendors have a space for trading and Honiara residents have access to fresh produce. This would increase resilience markedly Develop an action plan as an accountability mechanism to ensure that recommendations are implemented in a planned and systematic way
Disaster Risk Reduction	<ul style="list-style-type: none"> Honiara Market Risk Management Plan: draft in collaboration with stakeholders, review, finalise and communicate this plan. Include clear conditions for closure, access to farmers/markets in emergencies, safe storage of supplies, clearance of drainage in anticipation of disaster, reestablishment/ use of public address system for communication, use of cool store for (emergency) supplies, and use of the market truck to remove rubbish 	<ul style="list-style-type: none"> Reinstate generator for emergency use / backup supply of electricity
Capacity Development	<ul style="list-style-type: none"> Raise awareness of climate change risks and disaster management plan preparedness and response actions and responsibilities, including poster for display at market Upskill market vendors through the MVA on water, energy and waste management and conservation as new initiatives are introduced 	<ul style="list-style-type: none"> Examine measures to improve access for market vendors to savings schemes and protection of assets. Again this information can be shared through the MVA

8. Conclusion

Overall, this study has observed climate change to be a very real threat at both study sites and in fact across the Solomon Islands. This risk is not simply a result of coastal and floodplain market locations that are susceptible to sea level rise, king tides and storm surge, though this is true, but also, and more significantly, of institutional, social, political and economic factors.

The study was successful in gathering adequate information to understand the actual and potential impacts of climate change on the market system and to identify areas of severe vulnerability that can be addressed by the M4C project, municipalities and other relevant stakeholders.

The study identified Auki market to be more resilient across all areas, though similar problems are faced. Both markets are in coastal locations adjacent to rivers and within the floodplain of that river but are reasonably well protected, well-constructed, cyclone-resistant and with adequate drainage infrastructure. However, both markets have no operational water supply due to maintenance issues. The lack of a system, responsibilities and finance to drive a maintenance regime also causes issues for waste disposal, water and energy security and drain blockage, which in turn leads to health risk and serious implications in combination with a natural hazard. Honiara has the added risk factors of higher crime and a long history of political unrest causing social disorder, plus this

market faces severe overcrowding problems on its small site bound by the sea and the main road on both sides.

The study has made an attempt to recommend achievable and realistic solutions that can be implemented at the markets themselves at little outlay either immediately or planned over the next few years, with particular focus on no-regret strategies to ensure that investment has multiple benefits to the community. These initial recommendations must be fed into an action plan in consultation with Markets for Change and Municipal market staff to set a realistic and achievable plan for implementation, and will be closely followed by the development of disaster risk management plans for the markets to raise awareness within the community and local government and market staff of the risks that the markets will face in the future and the appropriate preparedness and response activities needed to minimise the impacts of climate change and disasters on the livelihoods of market vendors. It is important that these 'Disaster Risk Management Plans' are also developed in collaboration with stakeholders in Honiara, tailored to suit the local context and paired with effective information dissemination measures.

The assessment forms a baseline from which to monitor the performance of climate change adaptation policy and interventions and by which development can be implemented and progress measured.

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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 do 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 managed, 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?
3. Finance	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?
	3.1: Are social and economic safety nets or financial services available? E.g. welfare benefits, earthquake levy, loans, insurance
4. Addressing Causes of Vulnerability	3.2: Do you have other sources of income? What are they?
	3.3: Do you plan for /save or invest in the future?
	4.1: Do men and women work together to deal with problems?
	4.2: Do households have control over critical livelihood resources? E.g. land?
4. Addressing Causes of Vulnerability	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:




Auki Market Assessment

<p>1.0: Location:</p>	
<p>Description: located at the eastern end of town on foreshore and within approx.. 100m of rivermouth. Seawall in place to stabilise foreshore, gabion baskets along riverbank to prevent erosion</p>	
<p>Areas of Concern: Close proximity of both sea and river system means risk in the context of climate change / in the event of a disaster. Some erosion evident at river. Also affects accessibility in such conditions.</p>	
<p>2.1 Building:</p>	
<p>Description: New purpose-built building funded by JICA: 2012 completion. Solid design and construction with concrete floor and pillars, iron roof, no walls. Proposed Auki evacuation centre. Clean, safe, no asbestos.</p>	
<p>Areas of Concern: Purpose built as per plan, however maintenance needs not adhered to and many features not utilised due to poor planning or poor services e.g. butchery, cool room, fish sales area and rubbish storage room not used as either unsuitable or lacking power/water supply.</p>	
<p>2.2 Associated infrastructure:</p>	
<p>Description: Market office, concrete parking area, sea wall, waste disposal area, rubbish storage building, toilet facilities, two washbays. No accommodation (despite long travel times).</p>	
<p>Areas of Concern:</p> <ol style="list-style-type: none"> 1. Toilet facility closed due to water problems; poor disabled access 2. Need infrastructure once water reinstated: i.e. connection, hosepipe, hoses, waterblaster 3. Will need new security fence prior to new infrastructure installation 	
<p>2.2a Main Produce</p>	
<p>Description: Market has about 150 vendors most days. It is the main source of income for most vendors. Produce includes fruit (watermelon, pawpaw and lime; pineapple from Sept to Dec); vegetables (root crops, greens, aubergine, coconut, peanuts; fish: (afternoons - many undersized); fish & chips and other prepared foods, retail outlets with packaged foods, some handicrafts and clothing.</p>	

Governance and finance mechanisms:	
<p>Description: Governed by (acting) Market Manager, assisted by JICA volunteer Market Supervisor and 5x revenue collectors. There is an MVA with about 30 members. Annual joining fee is \$50 on top of market fee of \$10/day (veg); \$20/day (fish/fruit/other-more space). Vendors leave early if all produce sells. All revenue is sent directly to government. There is no maintenance budget or emergency funds. Small loans of \$1000 are offered to members (with security) for justified case (usually to buy more product. Interest is charged at 20%.</p>	
2.4: Waterways, coast and other natural features:	
<p>Description: Market is situated on reclaimed land along sheltered coast (south boundary). Proximity of sea poses no immediate threat as solid sea wall of gabion baskets has been built and set back distance is approx.20m.</p> <p>Land is also near river (approx. 150m east from market). Flooding of this river is said to be rare because it overflows to the flood plain to the east e.g. during TC Pam. It is protected by gabion baskets. There is some damage to the gabions from TC Pam.</p>	
Areas of Concern: Erosion checks should be responsibility of the maintenance officer	
2.5: Disaster Risk Reduction:	
There is no disaster or risk management planning for the market currently. A disaster plan is soon to be released by the provincial government.	

Services:

3.1 Energy:	
<p>Description: Market is on mains power (Solomon Power-diesel). Generator was stolen and there is now no alternative supply. Unpaid electricity bills have been a problem in the past. This debt is now settled. Electricity for lighting and security is sourced from source.</p>	
<p>Areas of Concern: Solar power may be a viable option for the market to reduce running costs and as backup during disasters/if market is to be used for evacuation centre.</p>	
3.2 Water:	
<p>Description: No running water. Some confusion over whether there is a connection to mains/Water Authority and if so, where. Debt owing has now been settled. Market has underground rainwater tanks fed with broken electric pump (pump maintenance neglected). Fibreglass (aboveground) tank leaks due to sun exposure. In dry periods the tanks dry up and are supplemented by water tank deliveries (if storage tank available). Funding is slow due to indecision between grant/govt funds.</p>	
<p>Areas of Concern:</p> <ol style="list-style-type: none"> 1. Fix water pump and fibreglass tank leak and connect to mains water (as reserve) 2. Establish maintenance officer 3. Vendor awareness of new system and how to use water 	

3.3a Accessibility:	
Description: Road access around urban Auki is ok, and maintained. The market itself has a small and cramped offloading and parking area: much smaller than plan due to land issues and poor collaboration between Ministry of Land and Ministry of Infrastructure. Fishermen access the market from the seaside.	
Areas of Concern: 1. More allocated space for offloading area 2. Designated parking for taxis and personal vehicles	
3.3b Transport:	
Description: Road access from rural Malaita is difficult. Requires 4WD vehicle or boat, often by night for vendors and limited to about 50% of the island. As other 50% need to take a boat they are more likely to go to Honiara. Sea access to Honiara is regular: several times daily by boat and plane. Road access to/from Auki takes 3 hours from the eastern (Atori) and southern extent (Heo) and 6-7 hours from the northern extent via Malu by personal vehicle (~\$150) but market vendors truck-pool. About 5x/year the road is closed following bad weather. Road repair takes up to 3 weeks	
Areas of Concern: Investigate boats as alternative option	
3.4 Drainage (engineered/natural):	
Description: Drainage is well planned and designed in the purpose built building. Discharges directly to sea. Lack of maintenance cycle has led to regularly blocked drains. The market needs a daily hosedown but the drain cleaner resigned and was not replaced.	
Areas for Improvement: 1. Maintenance budget and officer 2. Water reinstatement to allow regular hosing down of market area to improve drainage, reduce smell/health risks and relocation of fish back to intended location.	
3.5 Waste management:	
Description: Dedicated rubbish shed is used for accommodation instead of rubbish. Rubbish is stored outside in the sun very near the drain and sea. Smells. Waste is predominantly organic. It is separated somewhat and collected daily. Green waste is sent to the rural training centre where it is fed to pigs and made into compost for the school. The market cleaners have been sent on a field trip to the composting facility to raise their awareness. Drainage discharges directly to sea except toilet which has a septic tank.	
Areas for Improvement: 1. Relocate rubbish dump to purpose build storage shed once new bins arrive for segregation 2. Investigate alternatives for waste disposal (currently \$10,000/month) e.g composting on site (space an issue), or purchase of a trailer for storage and carting 3. Need to raise awareness if compost implemented.	

APPENDIX FOUR:

Honiara Market Assessment

Environmental:

2.1 Building:

Description: Large well-constructed main building with skylight. Was JICA funded, Japanese built approx. 1995. Solid, cyclone proof construction with steel beams and concrete floor.

Areas of Concern: N/A



2.2 Associated infrastructure:

Description: Main office, storage room, generator room, kiosks (lock-up shops), unused cool store for storing ice, parking lot, broken wharf, newly upgraded toilet block (UNW funded – now privatised and therefore cleaner and better-maintained). There are three proposals in place to extend kiosks to the rear to add another line of shops; for roof extension along west side of market to protect from weather (UNW to fund 50% in partnership with HCC); and for new wharf for fish unloading.

Areas of Concern: Backup generator, PA system, cool store and wharf: none are operational; all need repair. VERY crowded space.



2.2a Main Produce

Description: Wed, Fri and Sat are the busiest. Large variety of fruit and vegetables, nuts, fish, oil, handicrafts are sold. Second-hand clothing, alcohol and betelnut are not permitted but are widespread. Alcohol and betelnut sales are hidden. Fish supply is irregular. Often 'old' fish sold from netting boats and resold otherwise fresh fish from local fishermen caught early in the morning using bamboo raft. Fish is sometimes contaminated by unclean washing water. Attempts have been made to improve fish quality, practices and sales.






Security:

Description: Broken perimeter fence and boom gates. At night people drink and sleep in market and area is very unsafe, particularly for women. Equipment is regularly damaged and stolen e.g. fire extinguishers, hoses, hosepipes and connections. HCC enforcement officers are not effective. The market stays open way beyond operating hours of 6am-5pm due to lack of security or gates. Lighting automatically on at 6pm.

Areas of Concern: Missing boom gate and large sections of perimeter fence need to be replaced to reduce opportunity for crime.



Governance and finance mechanisms:	
<p>Description: Jimmy – market manager is assisted by assistant, 5 x cleaners and 15 x revenue collectors. Revenue is collected from all vendors including illegal vendors on other side of fence on southern side (but not west). Revenue is managed solely by HCC therefore very little is returned to the market for upgrades or maintenance. Any upgrade costs are shared 50/50 between UNW and HCC. There is an approved budget for expenditure but all must be requisitioned from HCC. There have been cases of corruption with HCC collectors taking money. There are administration problems such as missing acquittals e.g. from toilet upgrade therefore no further funding (for security fencing) is available yet. There is a standing committee for market management. The occasional clean-up day has been held, usually with a good turnout.</p>	
2.4: Waterways, coast and other natural features:	
<p>Description: No vegetation. Honiara market coastline is well protected with a sea wall but very little setback distance. Wrecked ships litter the coast. Mataniko floodplain extends to the market. During the 2014 flood, the market remained open but eventually had to close. The bridge was damaged and closed to heavy traffic. The secondary bridge was washed away and took 2-3 months to replace with a Bailey bridge. Many farmers in East and West Guadalcanal were cut off from the market or had to walk long distances for many months due to damage to bridges further upstream. Initially prices were cheap as vendors tried to sell off food quickly. As it began to spoil and the impact upriver was felt, prices increased and supply dropped.</p>	
<p>Areas of Concern: Market access is reliant on bridges to the west and east; nearby Mataniko River occasionally floods the market.</p>	
2.5: Disaster Risk Reduction:	
<p>There is no disaster or risk management planning for the market currently. A Disaster Risk Management Plan is available for HCC, released in 2012</p>	
Services:	
3.1 Energy:	
<p>Description: Electricity is somewhat reliable and comes from mains supply. It is metered, and each shop has its own meter. Energy is very expensive in Solomon Islands as all sourced from diesel supply currently. The market must pay high commercial rates.</p>	
<p>Areas of Concern: The backup generator (housed in shed pictured) does not work.</p>	
3.2 Water:	
<p>Description: There is only water supply for toilets (bill paid by HCC directly). The market does not have a potable water supply. Current rainwater tanks are not operational. Water is necessary for washing of produce and for hygiene. Fish & chip shops must bring water from home. In Honiara City generally, residential water supply and pressure has improved as bores have been established.</p>	
<p>Areas of Concern: No water supply. Proposed addition of seven rainwater tanks (M4C/HCC). Concerns are that these will be rainwater dependant and uniped. Investigate layout, explore possibility of a bore for the market and need for an associated awareness programme.</p>	

3.3a Accessibility:	
<p>Description: Currently produce is unloaded anywhere as fence is broken. Due to overcrowding, market stalls have replaced the designated unloading area. The one-way road system is effective but the parking and unloading area is tight and overcrowded. The main road of Honiara is used for access and the market causes almost constant disruption to this road. Many farmers must sell to resellers due to lack of marketspace. Farmers typically arrive 3am-5am then leave. Boat moorings are available but no fee is able to be collected.</p>	
<p>Areas of Concern: Parking is limited. Disruption to road Farmers forced out by resellers?</p>	
3.3b Transport:	
<p>Description: 1 x truck is available for market use. Private trucks and public buses are shared to get produce from East and West Guadalcanal to the market. Vendors pay freight costs.</p>	
<p>Areas of Concern:</p>	
3.4 Drainage (engineered/natural):	
<p>Description: The drainage has been well-engineered but poorly maintained and is now severely blocked. The high pressure hosepipes for cleaning out have all been damaged and/or stolen. The drainage system gets the occasional jet clean by the fire service but service in the past but this is not sustainable.</p>	
<p>Areas for Improvement: Drainage is a big problem for the market. It is necessary to improve maintenance practices and in particular to clear drains before every storm.</p>	
3.5 Waste management:	
<p>Description: Rubbish is removed daily to a tip 10km away but there are limited vehicles for removal and drivers are not paid for overtime so sometimes the market goes days without a collection causing serious problems with piles of rubbish mounting up. Small improvements: Previously the market operated with 4 x skips and 1 x wheelie. Management has upgraded to 1 x skip bin and 8 x wheelie bins. Now that plastic is used in place of leaves to cover tables there is much less rubbish on the floor at the end of the day. Proposal for second-hand shredding machine from Jap mining company to be installed in carpark as part of community support initiative.</p>	
<p>Areas for Improvement: Waste is a big problem. Honiara market is untidy; there is lots of rubbish which becomes a severe inconvenience, eyesore and health hazard during flood and rain. Recommend that cleaner's role and responsibilities is reviewed to change attitudes e.g. overtime, incentives...need coordinated approach, possibly women cleaners, designated areas, enforcement and supervision.</p>	

APPENDIX FIVE: Auki Dataset

SEASONAL CALENDAR												
EVENTS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
SEASONALITY												
Hot season												
Cold season												
Immigration												
Migration												
Dry season												
Wet season												
INCOME												
Fish selling												
Festivals												
Food selling												
EXPENSES												
School fees												
Feasting												
HEALTH												
Flu/cough/cold												
Malaria												
Diarrhoea												
LIVELIHOODS												
Food shortage												
Water shortage												
House building												
Land preparation												
Gardening												
Watermelon planting												
Watermelon harvesting												
Yam planting												
Yam harvest												
Pineapple planting												
Pineapple harvesting												
Fish abundance												
HAZARDS												
Cyclone												
Flood												
Drought												
Fire												
Rough sea												
King tides												

Less vulnerable period is unshaded: when there are no disasters, high incomes, harvesting time

Vulnerable period is shaded: when the different hazard occurs, low incomes, and shortage of food/water, diseases

HISTORICAL TIMELINE	
YEAR	EVENT
1925	Death of Mr Bell
1942	WW2
1945	WW2 end
1950	Big earthquake damages Aoke Island: tsunami hit Aoke and sea level reaches Auki courthouse
1966	Cyclone Aeda
1972	Cyclone / flooding in Auki
1975-1976	Drought hits Malaita
1977	Big earthquake / landslide
1978	Solomon Islands Independence day July 8th
1982	Cyclone Benny
1986	Category 3 Cyclone Namu
1988	outbreak of Malaria in Malaita
1989	Political issues in Honiara and Auki - Police strike
1996-1997	Drought hit Malaita
1998	Ethnic tension
2000	Solomon Islands political coup
2001 - 2002	Height of Tension in Solomon Islands
2003 / 2004	Ramsi intervention / price of goods high
2006	China town in Honiara burnt down
2007	April 2 Western Solomon Islands tsunami
2012	Opening of Auki Market / Auki wharf
2012	POPA art Festival
2012	King tide affects Auki Market December
2014	M4C programme starts at Auki Market
2014	April flash floods in Honiara
2015	AMVA Launch March
2015 - 2016	Drought hits Malaita
2016	Outbreak of Red Eye in Malaita April - June
2016	Earthquake hits Malaita

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

VULNERABILITY MATRICES

Hazard vs Resources	Cyclone	Flood	Drought	Earth quake	Land Dispute	Tsunami	Bush Fire	Sea level rise	King tide	Political instability	TOTAL
Trees and plants	3	1	2	3	1						10
Fish, shellfish and marine resources	1	1	1	1	1						5
Infrastructure and land transport	2	2	0	3	3						10
Gardens and farms	1	2	3	3	2						11
Market land	2	3	1	3	2						11
TO TAL	9	9	7	13	9						47
Bridges and roads	3	3		3			0	1	1	1	12
Land	2	2		3			0	1	1	3	12
Root crops	2	0		2			0	0	0	0	4
Market centre	3	3		2			0	3	3	3	17
Schooleducation	3	1		2			0	1	0	2	9
TO TAL	13	9		12			0	6	5	9	54
Tree/Coconut	1	2		1			1	2			7
Clean Water / Food	3	0		2			2	3			10
Economic	2	1		2			1	1			7
Garden	2	2		2			2	3			11
Market	1	1		2			1	2			7
TO TAL	9	6		9			7	11			42
Coconut	0	1	0			3					4
Fish	0	0	0			2					2
Potato	2	3	3			0					8
Cocoa	0	1	0			0					1
Swamp Taro	0	0	0			3					3
Cassava	2	3	3			0					8
Peanut	2	3	3			0					8
Melon	2	3	3			0					8
TO TAL	8	14	12			8					42

APPENDIX SIX: Honiara Dataset

SEASONAL CALENDAR												
EVENTS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
SEASONALITY												
Dry sea son	x										x	x
Wet sea son	x	x				x						
EVENTS												
Election Day												
Migration												
EXPENSES												
School fees	x	x				x	x					
HAZARDS												
Cyclone	x	x	x	x			?		?		x	x
LIVELIHOODS												
Kumara				x	x	x	x				x	x
melon					x	x	x	x	x			x
mango										x	x	
yam and pana					x	x	x					
potato									x			
root crops	x	x		x						x		
tomato					x	x	x					
Nalinut								x				
Pawpaw		low	x	x	x	x	low	x	x	x	x	x
Cassava	x	x	x	x	x	x	x	x	x	x	x	x
Cabbage	x	x	x	x	x	x	x	x	x			
Banana	x	x	x	x	x	x	x	x	x	x	x	x
Margarine					x	x	x					
fish						low				low	x	x
(mama mu)			x					x				
Fish (bonito)	x	x	x							x	x	x
(reef)		x		x		x			no	no	no	x
Plant yam										x		
Harvest yam				x								
Plant pineapple	x											
Harvest pineapple	x	x				x						x
Plant melon			x					x				
Harvest melon							x					x

HISTORICAL TIMELINE		
YEAR	EVENT	IMPACT
2016 - June	Wrong information about ethnic tension	Widespread fear and police activity
2016	Slow sales in market	Nothing sells out and income low
	Beetle cutting coconut shoots	Low yield of fruit
	Conjunctivitis outbreak	No marketing; no income
2015	Market closure: two weeks for upgrades	No marketing; no income; no bus fare for school, space fee increases
	Long drought (7 months)	Water shortage, gardens dry
	Earthquake	Landslide damages some houses and gardens
	Cyclone Winston	Some trees and houses affected
2014	Dengue Fever outbreak	Hospital overcrowded and medicine shortages
	Flash flooding of Mataniko	Loss of lives and houses, market closure and shortage of produce, closure
	African snails outbreak	Reduce crop yield, spread through province
	National election	Closure of market
2012	Diarrhoea outbreak	Children and elderly die, no beds at clinics
	Murder of late Simon	Vendors fearful at market
	Arts festival	Price of crafts able to increase
	Prohibit selling clothing	Clothing sellers lost livelihood as no replacement offered
2011	Bird flu	People return to province, no sales
2010	National election	Riot, loss of market income
2006 - April	Riot	Market closes for a week, shops burnt down, town deserted, workplace
2007 - April	Tsunami and earthquake	Declared disaster: help from govt and aid; little impact in Honiara town
1998-2002	Ethnic tension	Collapse of economy and law and order; shops, markets, schools and ba
1986 - May	Cyclone Namu	No food, water, shelter, clinic, school.

	Human event (positive)
	Human event (negative)
	Natural event - cyclone
	Natural event - drought
	Natural event - earthquake
	Pest and disease

VULNERABILITY MATRICES

Hazard vs Resources	Cyclone	Flood	Drought	Earth quake	Land Dispute	Tsunami	SLR / King tide	Political instability	TOTAL
cocunut	1	4		0	3		3		11
House	5	4		4	3		2		18
Garden	4	4		1	2		0		11
Water	3	4		3	3		3		16
Fish	4	4		2	3		4		17
Education	5	4		3	3		3		18
TOTAL	22	24	0	13	17	0	15	0	91
Garden	3	3	3	1				0	10
Orchard	4	3	0	1				0	8
House	3	3	0	3				0	9
Marketing	3	3	0	0				4	10
Water	4	4	3	3				0	14
TOTAL	17	16	6	8	0	0	0	4	51
Land	3		1	4			3	0	11
House and garden	4		3	3			3	0	13
Services: school / hospital / market	3		2	3			3	3	14
Farmers	4		4	2			0	1	11
Families	4		3	5			3	2	17
TOTAL	18	0	13	17	0	0	12	6	66
Land	3	3	4				4	0	14
Forestry	2	2	0				2	4	10
Fish	4	4	0				3	3	14
Farming	4	4	1				2	4	15
Market	4	4	3				4	4	19
Education	1	1	1				1	4	8
Transportation	4	3	0				1	4	12
TOTAL	22	21	9	0	0	0	17	23	92

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

Solomon Islands Office

United Nations Joint Presence Office Ground Floor,
ANZ Haus, Kukum Highway,
Ranadi Solomon Islands
Tel: + 677 22463

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