

CLIMATE RESILIENT WASH IN RURAL COMMUNITIES IN FIJI

by

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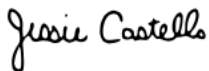
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Vinaka Vakalevu!

Abstract

Many Pacific Island Countries (PICs) are struggling to achieve the Sustainable Development Goals (SDGs) and there is strong evidence that climate change is exacerbating existing barriers and creating new challenges to meeting the SDG targets. Changes in the quality and quantity of water resources are some of the primary ways in which climate change is predicted to impact human and ecological systems. In Fiji, climate change is magnifying the country's natural climate variability and increasing the intensity of extreme weather events. This research involved a literature review and semi-structured key informant interviews to gather data on climate-resilient WASH in rural Fiji. Among the solutions, Drinking Water Safety and Security Planning (DWSSP), Integrated Water Resource Management (IWRM) and nature-based solutions to hardware were identified as key to building resilient WASH services.

Key Words: Climate Change, DWSSP, SDGs, Resilience, WASH

Executive Summary

Introduction

The country of Fiji is made of over 300 islands, from large and mountainous to small atolls (GoF, 2017a; Pearce, et al., 2017, p. 502). While Fiji has an abundance of fresh water resources, the diversity of the islands, means that access to these resources is not evenly distributed (Gof, 2017a). Consequently, Fiji has not yet achieved the Sustainable Development Goal (SDG) targets of universal access to safely managed water, sanitation and hygiene (WASH). Furthermore, many communities that do have access to water resources, have yet to reach the SDG standard of safely managed WASH services (GoF, 2017b). As of 2015, fifty-eight percent of the rural population had access to “clean and safe water in adequate quantities”(GoF, 2017b).

Fiji’s location in the South Pacific Ocean means that it experiences significant climate variability and is susceptible to extreme weather events (GoF, 2017a; Scott, et al., 2003). The Intergovernmental Panel on Climate Change (IPCC) states that water is the primary avenue that climate change is predicted to impact communities (Bates, et al., 2008). Climate change is predicted to impact WASH through increased severity of extreme weather events, sea level rise, higher average land temperatures and an increase in variability of precipitation (G nevaux, 2018). Each of these climate-related hazards will impact the quantity and quality of water and thus create risks to communities’ health and environment (Bates, et al., 2008; G nevaux, 2018). However, when looking at climate change at a local scale, the impacts are more challenging to predict due to the influence of social, economic and environmental factors (Bates, et al., 2008; WHO, 2016).

The relationship between climate change, disasters and water resources suggests coordination is needed among these sector (WHO, 2016). However, there remain gaps in how the WASH sector is integrating climate change into projects and programmes at the local level (Batchelor, et al., 2011). For Fiji, with communities that are already experiencing the impacts of climate-related hazards and which have existing challenges to achieving safely managed WASH services, the need for climate-resilient WASH is critical to achieve SDG six.

Research aim and objectives

The aim of this research dissertation is to identify how stakeholders in Fiji’s WASH sector are addressing the threats and impacts of climate-related hazards to rural WASH at the local level. The following objectives have been identified to meet the research aim.

- **Objective 1:** To assess Fiji’s rural WASH sector
- **Objective 2:** To determine key climate-related threats to WASH in rural Fiji.
- **Objective 3:** To identify good practice approaches to climate-resilient WASH.

- **Objective 4:** Present recommendations based on comparisons made between interventions in Fiji and those identified in the literature reviewed.

Methodology

This research dissertation utilized a literature review and semi-structured key-informant interviews (KII) to gather data. The literature review was essential to provide the context and background necessary to inform the semi-structured interview questions (Bryman, 2016). Semi-structured interviews were selected due to their appropriateness for allowing participants in the research to flexibly address the general questions identified in the literature review (Bryman, 2016). KIIs were selected to gain local perspectives from stakeholders with significant experience working with communities in Fiji. The methodology choice is supported by similar research into climate-resilient WASH conducted by Hadwen, et al. (2016).

Thematic analysis was used to analyse the KII data and compare and contrast it with key concepts in the literature review. Thematic analysis was chosen so that a wide variety of data could be clearly presented by being grouped into themes and sub-themes. The KII data was manually coded using descriptive coding to enable themes and sub-themes to be developed from the data. As this research was focused on gaining insights into local perspectives, thematic analysis and manual descriptive coding were also important to retain the context in which the data was given.

Objective 1 results: to assess Fiji's rural WASH sector

The literature review provided an overview of the main stakeholders in the WASH sector and illustrated a sectoral approach at the national level. Through examining the literature for the specific roles and responsibilities of the various ministries and government departments and also taking into consideration the relevant data from KII, the fragmented nature of Fiji's WASH sector was highlighted as a key barrier to achieving SDG six. However, the KII data showed that a national water resources and sanitation policy is being developed to address the fragmentation in the WASH sector and provide guidance for implementation at the local level. This policy will promote the use of Integrated Water Resource Management (IWRM) and Drinking Water Safety and Security Planning (DWSSP) as methods of integrating climate change and WASH. Government stakeholders at the sub-national level were more difficult to distinguish through the literature and thus KII data was relied upon to fill this gap. KIIs revealed the important role that local government plays in the long-term support of donor funded projects. However, the lack of capacity and resources at this level was identified as another challenge to the sustainability of rural WASH services.

Further barriers to achieving SDG six were identified from comparing the literature and KII data. The main barriers are: lack of community ownership, inappropriate or poorly designed

infrastructure, insufficient training and support on management of systems, and land practices that exploit or pollute water resources.

Objective 2 results: to determine key climate-related threats to WASH in rural Fiji

There was a large focus in the literature and the KII data on key climate-related hazards in the form of extreme weather events. As such, damage to infrastructure was the most commonly cited way climate change is and will impact WASH. While the literature discussed the threat of increased land temperature and rainfall variability, these were absent from the KII data. However, these slow-onset threats of climate change have the potential to greatly impact WASH services that are not designed to take into account large fluctuations in water quality and quantity. Sea level rise was also considered a key climate-related threat in this research and is described in both the literature and KII data as impacting the quality of groundwater and disrupting the function of sanitation systems that utilize septic tanks or pits to treat excreta.

Climate-related threats are currently and will continue to exacerbate the existing barriers to the achievement of SDG six. The literature offered in-depth explanations of how climate change influences the water cycle and this is supported by specific examples offered in KIIs. The complexity that climate change adds to WASH requires an existing level of capacity among stakeholders at all levels. However, the research shows that the non-climate related barriers to achieving SDG six have yet to be overcome. Therefore, the foundation for addressing climate change is not yet established.

Objective 3 results: to identify good practice approaches to climate-resilient WASH

The concept of requiring adequate capacity to address existing non-climate related barriers to safely managed WASH services helped to inform the evaluation of good practice approaches to climate-resilient WASH. In comparing literature and KII data it became apparent that there was not currently much consideration given to climate-resilient WASH. The limited data that was available described both software and hardware solutions to climate-resilient WASH. DWSSPs and nature-based hardware solutions were concluded as the most appropriate for achieving resilience, with the support of IWRM for high level guidance. However, a significant portion of the literature and data focused on projects that described their deliverables as resilience but were only helping communities achieve a basic level of WASH service. While it is acknowledged that moving from unimproved WASH to basic WASH does contribute to resilience, it does not achieve resilience. This research considers that a system is resilient when it can absorb, adapt and transform in response to climate-related threats. WASH systems that satisfy the SDG criteria for safely managed are thus considered the most resilient to climate change. Communities that have achieved this level of services are assumed to have sound management capacity, including financial management, which

enables them to not only respond to shocks but plan for the long-term changes caused by climate change.

The issue of misrepresenting projects as climate resilient is two-fold. Firstly, funding for climate change resilience is commonly from external sources, versus capital for WASH projects that require contributions from target communities to promote ownership of the project. Therefore, if external funding is used to supply infrastructure that provides a basic level of service, it undermines good practice approaches in the WASH sector. Secondly, project implementers may misinform communities on what is needed to build sufficient resilience to climate-related threats, leading to inadequate measures being put in place.

Recommendations

In order to support building further capacity in the WASH sector, this research makes the following recommendations to Civil Society Organisation (CSOs). Firstly, all CSOs should allocate resources to building capacity of the local government staff that they rely upon for the long-term support of their deliverables once project funding has ended. Secondly, a greater emphasis is needed on building the financial management capacity to empower communities to build their own resilience to climate-related hazards. Finally, increased knowledge sharing between government and CSOs and between CSOs across all sectors involved in water resource management is needed to share lessons learnt on the implementation of DWSSPs, nature-based hardware solutions and IWRM.

This research concludes that government has a critical role to play in defining climate-resilient WASH activities to ensure correct allocation of funding and appropriate training with communities takes place.

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List of Acronyms

CCICD	Climate Change and International Cooperation Division
CCA	Climate Change Adaptation
CSO	Civil Society Organisation
DRR	Disaster Risk Reduction
ENSO	El Niño-Southern Oscillation
GoF	Government of Fiji
IWRM	Integrated Water Resources Management
MDGs	Millennium Development Goals
NDMO	National Disaster Management Office
NDP	National Development Plan
PAO	Provincial Administrators Office
PIC	Pacific Island Country
SDGs	Sustainable Development Goals
SIDS	Small Island Developing States
SPCZ	South Pacific Convergence Zone
WASH	Water, Sanitation and Hygiene

1. Introduction

1.1 The context and research problem

The country of Fiji comprises over 300 islands spread over an area of 18,000 square kilometres in the South Pacific Ocean (GoF, 2017a). The population of 900,000 is spread across 110 islands with the majority living on the two largest islands of Viti Levu and Vanua Levu (GoF, 2017a). Fiji's islands are a mix of "mountainous... volcanic islands, low-lying atolls and elevate reefs" (Pearce, et al., 2017, p. 502). Fiji is faced with numerous development challenges and the Government has laid out ambitious targets to addressing these issues in its National Development Plan (NDP) (GoF, 2017b). Among these targets is "100 percent access to clean and safe water... for rural and maritime areas by 2030" (GoF, 2017b). However, in rural areas over thirty-six percent of people live in poverty and only fifty eight percent of people have "access to clean and safe water in adequate quantities" (GoF, 2017b).

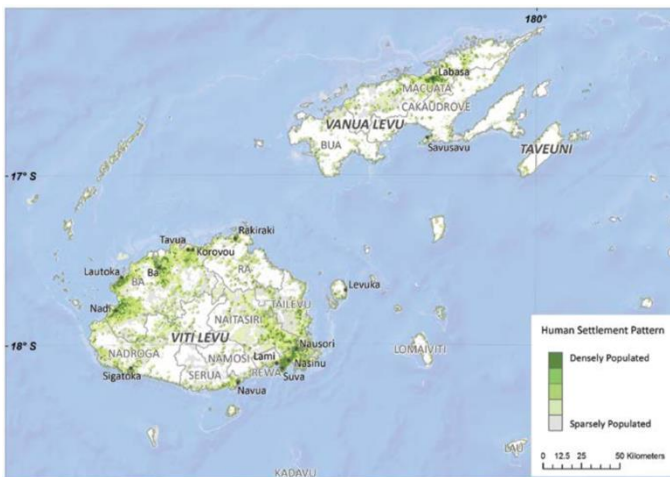


Figure 1: Map of Fiji Islands (GoF, 2017a, p.55)

Climate change is at the forefront of development issues for many Small Island Developing States (SIDS) as impacts from climate-related hazards are already impacting human and environmental health (Nurse, et al., 2014). An estimated eighteen percent of Fiji's population "live in low-elevation coastal zones" (GoF, 2017a). These communities are threatened by sea level rise and storm surges. In addition to a rise in sea levels, Fiji is threatened by a predicted increase in the intensity of tropical cyclones and floods, as well as, variability of rainfall and a rise in average land and sea temperature (GoF, 2017a). Fiji has shown leadership in expressing the threats of climate change faced by SIDS on the global stage (Chaudbury, 2015). Additionally, the National Climate Change Policy (2019) illustrates how the Government is focused on integrating climate change adaptation and mitigation into all sectors.

Due to the rapid pace of social, economic and environmental changes that many SIDS have experienced in last half of the century, it has been difficult for experts to identify impacts explicitly linked to climate change (Nurse, et al., 2014). This is especially true when discussing climate change and water, sanitation and hygiene (WASH). Climate change is intrinsically linked to the hydrological cycle, however the hydrological cycle is also influenced by human activities (Deere et al., 2017). Therefore, in order to achieve the targets laid out in the NAP, as well as the Sustainable Development Goals (SDGs), WASH in rural areas must be resilient to climate change. However,

the climate change sector is often accused of overlooking the local perspectives and traditional knowledge (Kelman and West, 2009). Furthermore, it is unclear whether practitioners in the WASH sector have adequate knowledge training in climate change to plan appropriate solutions (Batchelor, et al., 2011). These issues are compounded by the lack of practice, evidence-based guidance on how to integrate climate-related threats into WASH projects and programmes.

1.2 Research aim, objectives and questions

Research aim: To identify how stakeholders in Fiji's water, sanitation and hygiene sector are addressing the threats and impacts of climate-induced hazards to rural WASH at the local level.

- **Objective 1:** To assess Fiji's rural WASH sector.
 - Who are the main stakeholders in Fiji's WASH sector?
 - What are the key policies and strategic plans governing the sector?
 - What are the major challenges to achieving SDG 6 in rural areas?
- **Objective 2:** To determine key climate-related threats to WASH in rural Fiji.
 - What are 'key' climate-related threats and how are these determined?
 - What is their impact on WASH?
 - How do these threats relate to non-climate related threats to sustainable WASH in rural Fiji?
- **Objective 3:** To identify good practice approaches to climate-resilient WASH.
 - How are climate-induced hazards addressed in WASH software and hardware?
 - How do these approaches vary between stakeholders?
- **Objective 4:** Present recommendations based on comparisons made between interventions in Fiji and those identified in the literature reviewed.
 - What are the gaps that the literature and research have identified?
 - Are there opportunities for increased knowledge sharing between government stakeholders and CSOs in Fiji?

1.3 Research scope

The focus of this research is rural WASH and climate change in Fiji and it is acknowledged that, separately, these are each large and complex topics to investigate. Therefore, in order to narrow the scope to a manageable size, an iterative process was used to include information that was only necessary to provide adequate background and context to support or identify significant gaps in the research data. Furthermore, this research focuses on local perspectives of WASH and climate change and implementation at the level rather than describing in detail the high level challenges and policy debates surrounding these sectors. It is also important to acknowledge that this research does not aim to produce conclusions that are representative of all local stakeholders.

Finally, responding to climate change involves both mitigation and adaptation (Genevaux, 2018), however, due to relevance to rural WASH in Fiji, only adaptation is considered in this research.

1.4 Application of research

The aim of this research was designed to help provide insight into the challenges of implementing climate-resilient WASH projects in rural communities in Fiji. As such, it is the hope of the researcher that the conclusions and recommendations of the research can be shared with WASH practitioners. Furthermore, the areas for further research that are identified can help inform future research in Fiji.

2. Literature Review

2.1. Introduction

This literature review will examine the literature written on WASH in Fiji, climate change in Fiji, and climate-resilient WASH. Additionally, this literature review will look at the terminology that is central to this research. By comparing the literature on these topics, this literature review will inform the following objectives of this dissertation.

- Objective 1: To assess Fiji's WASH sector;
- Objective 2: To determine key climate-related threats to WASH in rural Fiji;
- Objective 3: To identify good practice approaches to climate-resilient WASH;
- Objective 4: To present recommendations based on comparisons made between interventions in Fiji and those identified in the literature reviewed.

The literature reviewed on WASH in Fiji and climate change in Fiji provides context that is necessary to examine the literature climate-resilient WASH. This literature review contrasts the different challenges facing the WASH sector in Fiji and examines how or if these are influenced by climate change. Additionally, recommended actions for moving towards climate-resilient WASH are assessed against one another, focusing on practical application at the local level and identifying the differences of these from WASH interventions that do not explicitly address climate change. Finally, this literature review will provide a summary of learnings and highlight gaps that provide justification for this research dissertation.

Many Pacific Island Countries (PICs) did not achieve the Millennium Development Goals (MDGs), and climate change is exacerbating the barriers to reaching the targets set by the Sustainable Development Goals (SDGs) (WHO, 2016). There is strong consensus in the literature that WASH interventions must make drastic improvements to how the threats of climate change are addressed, in order to achieve SDG Six (Deere, et al., 2017; Genevaux, 2018; Howard and Bartram, 2010; UNICEF Pacific, 2018; WHO, 2016). Recommendations for practical action for incorporating climate change into the WASH project cycle vary within the literature. There are

differing opinions on appropriate methods of addressing climate change at the community scale. To investigate practical approaches to climate-resilient WASH, defining climate change terminology is critical to ensure clarity and consistency. In the following paragraphs, relevant background on terminology, WASH in Fiji and climate change in Fiji will be investigated to provide context for examining the literature on climate-resilient WASH for similarities, differences, lessons learnt, and gaps.

2.2 Defining key terminology

There is extensive literature that describe the debates on key concepts in Climate Change Adaptation (CCA) and Disaster Risk Reduction (DRR) sectors. The scope of this research is to draw out points in the discussions regarding concepts that are relevant to climate-resilient WASH. Varying definitions for key concepts were identified during the literature review. Appendix A provides the definitions that are used in this research, which were selected based on the credibility of the source and their relevance to climate-resilient WASH. Genevaux (2018) provides useful application of how these concepts interact when looking at WASH, which is summarized in Figure 1. The focus on risk in addressing resilience in Figure 1 is also supported by Scott, et al. (2003) and UNICEF Pacific (2018). This structure will be utilized when looking at the specific climate-related hazards in Fiji.



Figure 2: Adapted from Genevaux (2018, p. 19).

2.3.1 Resilience

A common theme identified in the literature reviewed is the distinction of the two terms ‘resilience’ and ‘vulnerability’. These terms are not opposites but rather “multidimensional and multifactorial... [and] all peoples, places and communities have aspects of vulnerability and resilience to different degrees and in different ways” (Kelman, 2018, p.4). Exposure and sensitivity to a hazard are two of the key components of vulnerability. Smith and Wandel (2006, p.286) state that “access to social and financial resources, information and technology... [and] effectiveness of institutions” all influence exposure and sensitivity to hazards and thus vulnerability. Therefore, vulnerability is “created not by the environment but by poor decision-making, practices... and planning” (Chmutina, et al.,

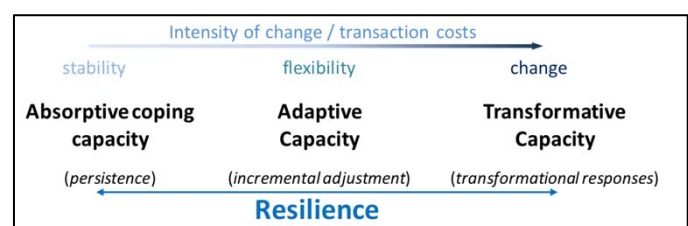


Figure 3: “3D Resilience Framework” Smith and Wandel, et al., 2012, p. 21).

2017, ch.25). However, the literature reviewed differs on whether adaptive capacity or resilience is the third factor (Smith and Wandel, 2006; Thomalla, et al., 2006). Luh et al. (2017, p. 336) state that adaptive capacity differs from resilience in that it describes what can potentially be done to either “moderate potential damages, take advantage of opportunities, or to cope with the consequences” of climate change. However, the definition used in this research for resilience encompasses the ability to adapt and transform. Therefore, when discussing resilience, it will go beyond investigating a system’s ability cope with climate-related impacts and examine also how systems area can towards transformational change, keeping in mind what is needed to resist the effects of a hazard may not be the same as what is necessary to adapt to it (Béné et al., 2012; G nevaux, 2018; Luh, et al, 2017).

2.3.2 Integrating Climate Change Adaption and Disaster Risk Reduction

Another concept that is discussed in the literature is the integration of CCA and DRR and there are many aspects of this discussion that are relevant to this research.

The first element is that of risk management, which is discussed in the context of CCA and DRR integration by Gero, et al. (2011) and SPC, et al. (2016). UNICEF Pacific (2018, p.17) defines risk management as “the process by which risks are considered within a system, and how they are addressed”.

Kelman (2015, p.118), explains that climate change “is one factor influencing certain hazards with the potential to contribute to disasters where vulnerability and exposure exist”. Similarly, Chmutina, et al., (2017, n.p) describes how climate change is becoming known as a “risk-multiplier”. Kelman (2015), Seidler, et al. (2018) and SPC et al. (2016), all call for integrated management of climate and disaster risks to increase efficient use of resources within these sectors. Similarly, Batchelor et al. (2011, p.20), suggests that the WASH sector should “treat climate change as one of the many sources of risk and uncertainty that impact upon sustainable WASH access”. Alternatively, within CCA and DRR sectors WASH is one of the many key components that contributes to adaptation capacity (WHO, 2016).

Another important concept that is emphasized in CCA and DRR literature is promotion of low or no regret options to building resilience (Bahadur, et al., 2014; SPC, et al., 2016). This is also consistent with what is recommended in the WASH focused literature (G nevaux, 2018; UNICEF Pacific, 2018). G nevaux (2018, p.37) states that “no-regret options are measures or activities that will prove worthwhile even if no [further] climate change occurs”. A point that is emphasized in the literature and that applies to WASH is that DRR and CCA initiatives implemented at the local level are essentially the same and therefore it follows that these approaches and concepts should

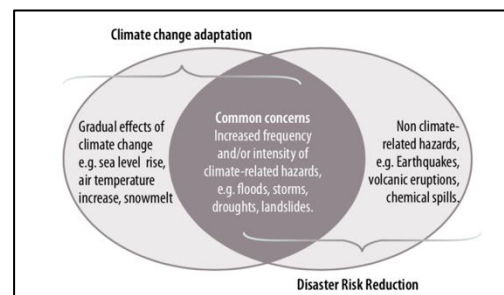


Figure 4: “Overlap of common concerns of climate change adaptation and disaster risk reduction (SPC et al., 2017, p. 7).

inform each other (Chmutina, et al., 2017; Gero, et al., 2011; Seidler et al., 2018). As previously mentioned, changes in access to water are often the main way that communities experience the impacts of climate-induced hazards, therefore, it is likely that DRR and CCA initiatives, while being similar to each other, may also overlap with WASH initiatives (UNICEF Pacific, 2018; WHO, 2016). However, SPC, et al. (2016) draws attention to that fact that the level of convergence between DRR and CCA initiatives will depend on local conditions. At the same time, the literature highlights a lack of evidence and guidance on the practical application of DRR and CCA (Chmutina, et al., 2017; Gero, et al., 2011; Seidler, et al., 2018). Bahadur, et al. (2014) is the only source that offers practical tools to guide DRR and CCA practitioners, noting that the absence of evidence-based approaches can lead to inefficient coordination and increased project costs.

2.3.3 Top-down versus bottom-up approaches to labelling

The literature provides practical information to assist in determining adaptive capacity and thus how initiatives can move towards resilience. Genevaux (2018, p.18), states that “anticipating potential impacts and preparing the appropriate responses” can build adaptive capacity. However, Genevaux (2018, p.31) emphasizes that this must be done at a local level so that adaptive measures are appropriate for the specific needs of a community. This is supported by Smith and Wandel (2006) who note the importance of understanding how a “community experiences changing conditions and the process of decision-making... that may accommodate adaptations” (Smith and Wandel, 2006, p.283). This discussion brings in a larger issue of top-down versus bottom-up vulnerability labelling. Climate change studies are often conducted by international teams of scientists at global and regional scales due to the challenges of modelling at national and local levels (Nurse, et. al., 2014). However, this inevitably leads to top-down labelling of vulnerable areas (Smith and Wandel, 2006, p. 285; Kelman and West, 2009). Kelman and West (2009) propose the use of bottom-up approaches to informing resilience projects so that community perceptions and local knowledge are understood. Beyeral et al. (2018) agrees, noting that there is a gap in community level knowledge that exists in climate change discourse at the international scale. Batchelor, et al. (2011) and Butterworth and Guendel (2012) provide further reason to support bottom-up approaches, pointing out that the uncertainty of climate change predictions at a local scale makes observations and historical accounts of community members vital to understanding threats.

Bottom-up approaches to determining vulnerability are also important to avoid negative outcomes as a result of external labelling. Kelman (2018) was the only source who discussed how classifying a community as vulnerable can create inaction. Kelman (2018) argues that an outcome of external labelling could be that the population then view themselves as powerless to adapt to the threats of climate change. This can influence their ability to help themselves, and thus become more

resilient. Conversely, an area or population that is considered resilient by others may not receive the resources they require to continue to adapt (Kelman, 2018). An example to support Kelman's (2018) observation is easily drawn out of the literature reviewed. In global reports, SIDS are often described as the most vulnerable to climate change due to their exposure to climate-related hazards, weak economies and lack of a skilled workforce (Caribsave, 2009). However, Kelman and West (2009, n.p.), point out that there are strong traditional factors that contribute to resilience of SIDS, including, "tight kinship, unique heritage, a strong sense of identity and community, creativity for sustainable livelihoods... and local knowledge and experience of dealing with environmental and social change throughout history". There is strong evidence of this in Fiji, where "important relationships... extend throughout the village... as well as relationships at the provincial, district and national levels (Gingerich and Vitale, 2017, p.28). Scott et al. (2003, p.7), support Kelman and West's (2009) view but go further to suggest the term vulnerability should be avoided as it "focuses on weaknesses and shortcomings rather than on inherent strengths and opportunities". Understanding the existing capacity of communities, is therefore, not only essential to build effective adaptive measures but also to avoid deterring local initiative.

2.3.4. Adaptation and development

A final topic within the discussion of terminology is the "distinction between adaptation activities and development activities" (Genevaux, 2018, p.31). UNICEF Pacific (2018, p.7) defines climate-resilient WASH as "the ability of Pacific communities and their WASH systems, the infrastructure for water and sanitation schemes and the people who are managing them to adapt to changing conditions in their environment, absorb negative impacts/shocks, and have the ability to recover". Similarly, Luh, et. al. (2017, p.335) defines WASH resilience as "the water and sanitation technology's ability to absorb disturbances from climate-related events while maintaining its same basic structure and ability to function". However, these definition does not describe transformational change, which is considered a core component to resilience (Béné et al., 2012; Genevaux, 2018). While there is an abundance of literature on the defining resilience and adaptation, there is a gap in defining these concepts in terms of practical action. As such, there is potential overlap between development projects and climate-resilience projects in the WASH sector, resulting in an inefficient use of resources and poorly implemented resilience activities (Genevaux, 2018). Furthermore, the difficulty in clearly defining climate-resilient activities has implications for funding. It is well established in the WASH sector that sustainability is built through community contributions of capital or in-kind to a project (Smet and van Wijk, 2002). However, addressing climate change is seen as a global responsibility, with developed countries taking responsibility for their high emissions by providing funding for climate change resilience in

less developed countries (SPC, et a., 2016). As Kelman (2018) emphasized in section 2.3.3, external assistance can create external dependency and thus there is a risk of undermining community ownership by mislabelling resilient projects. This concept will be further expanded upon in section 2.6.2.3.

2.4. WASH in Fiji

2.4.1. Key stakeholders, policies and strategic development plans

There are numerous stakeholders involved in rural water, sanitation and hygiene in Fiji. Figure 4 illustrates the hierarchy of key stakeholders in the WASH sector. Furthermore, Table 1 provides an overview of the role of stakeholders regarding rural WASH and any policies and strategic plans that are relevant to this research.

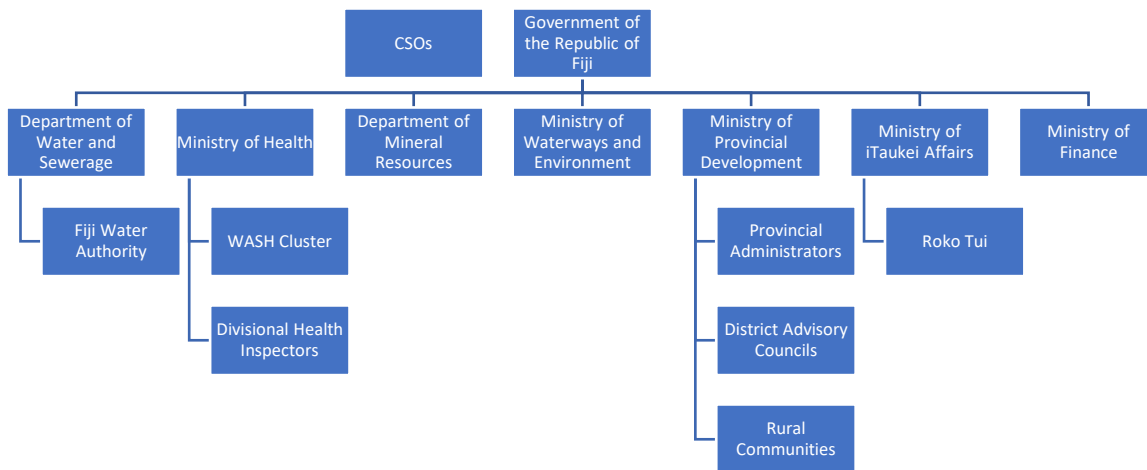


Figure 5 Stakeholder map of Fiji's rural WASH sector (adapted from [sources])

Table 1: Rural WASH sector stakeholders and their roles and responsibilities (<i>Unless otherwise noted, information in this table is taken from the GoF's 2016 Rural Water and Sanitation Policy</i>).	
Stakeholder	Role
Department of Water and Sewerage	“Leading agency on the formulation of ...policy... regulation... and monitoring... of [rural water and sanitation] schemes” (pp.13-14).
Ministry of Provincial Development	“Responsible for all Rural Development Planning... all requests for the construction of Rural Water and Sanitation Schemes will first register with the Ministry” (p.14).
Ministry of I-Taukei Affairs	“All <i>Tikina</i> (District) water and sanitation needs to be recorded by the Provincial Offices of the Ministry of I-Taukei Affairs [and the] Ministry... will monitor and document the operation and maintenance of all schemes in their district” (p.15).
Ministry of Health	“Responsible for “monitor[ing] the water quality standards together with the water safety planning of the Rural Water Schemes” (p.15).
Ministry of Finance	Responsible for reviewing all “project proposals requesting donor assistance... [and] for the budgetary allocation for Rural Water and Sanitation Schemes” (p.16).
Department of Mineral Resources	Responsible for “the planning, assessment and development of ground water resources” (SPREP, 2003, p. 70).
Ministry of Waterways and Environment	Responsible for “water policy planning and sustainable resource management” (GoFb, 2017, p. 19).
Water Authority of Fiji	“Responsible for the design and construction of Rural Water and Sanitation Schemes and will therefore co-ordinate, prepare, formulate, compile and fund Water Supply Management Plans for all prioritized projects. [Additionally,] they will collect the 1/10 th contribution from those seeking government assistance before commencing construction works” (p15).
Fiji Meteorological Services	“To observe and understand and understand regional weather, Fiji’s climate and hydrological patters, and provide meteorological and hydrological services in support of the well-being of communities,

	economic growth, environmental sustainability and international obligations” (Fiji Met, n.d).
WASH Cluster	“The primary purpose of the cluster is the delivery of water, sanitation and hygiene promotion assistance to affected populations during emergencies through improved coordination of the response at all levels” (MoH, n.d).
Roko Tui	Responsible for endorsing the water and sanitation requests of the Registered Fijian Villages that are within their Provinces before they are submitted to the Ministry of Provincial Development. (p.15).
District Councils	Responsible for water and sanitation needs of “Indo-Fijians and other minority groups within a district”, additionally they “will monitor and document the operation and maintenance of all schemes in their districts” (p.15).
CSOs	Support government by building capacity within government and communities, as well as providing funding and technical guidance (WHO, 2016). Any projects must be approved by the Ministry of Provincial Development (p. 16).
Communities	Overall responsibility of management, including operation and maintenance of WASH systems (SPREP, 2003).

Figure 4 and Table 1 illustrate that there are a range of stakeholders that are involved in rural WASH. The literature reviewed shows consensus on the need for improved coordination between institutions who have a role in rural WASH in order to tackle climate change (Paeniu, et al., 2016; SPREP, 2003; SOPAC, 2007; UNICEF Pacific, 2018). Literature published prior to 2010 describes the gap in policies and strategies to help promote coordination in the WASH sector (SPREP, 2003; SOPAC, 2007). However, a recent study funded by UNICEF showed the existence of numerous policies and strategies on rural WASH, water resources management, water supply and Integrated Water Resource Management (IWRM), a summary of which can be found in Appendix B (UNICEF Pacific, 2018). Yet, the study also highlighted that there are no water resources management nor IWRM plans to guide policy implementation (UNICEF Pacific, 2018). Therefore, while the call for an improved institutional framework to address climate threats is not new and progress has been made, a gap remains in mechanisms for the practical application of policies and strategies.

2.4.2. Current coverage

A review of the progress on the achievement of the Millennium Development Goals (MDGs) shows that Fiji has relatively high coverage of improved water supply and sanitation facilities in rural areas compared to other Pacific Island countries (WHO, 2016). UNICEF Pacific (2018, p.57) describes common water supply systems in rural communities in PICS as “rainwater capture and storage... gravity-fed system[s] usually from surface or spring sources... [and] groundwater from either hand-dug well[s] or borehole[s]”. However, it is important to note, the Fijian Government acknowledges the lack of data on WASH infrastructure in rural areas and describes this as an impediment to planning for climate change resilience (GoF, 2017). Data from 2015 showed that only 58 percent of the rural population had “access to clean and safe water in adequate quantities” (GoF, 2017b, p.10). The CIA World Factbook (2015) estimates that 88.4 percent Fiji’s rural population have access to improved sanitation. Regarding sanitation, most rural communities use on-site systems, but these often create health and environmental risks when construction and maintenance is poor (GoF, 2017a). The terminology of “improved” is based on the MGDs, however the more recent SDGs use of “safely managed”. When comparing literature on access to WASH, it is important to clarify definitions of the level of services.

Improved sanitation facilities refer to “facilities that are likely to ensure hygienic separation of human excreta from human contact” and these are considered to fulfil the requirements of basic sanitation but “may or may not... [include] safe excreta disposal” (WHO, 2016, pp. 31-32). The SDGs take into account the shortcomings of the MGD definitions and use the term “safely managed” which is defined as “use of improved facilities that are not shared with other households and where excreta are safely disposed of in situ or transported and treated offsite” (UN, 2018, p.45). For water supply, the MDG definition of safe drinking-water refers to water that is “available in sufficient quantities for...drinking, cooking, personal hygiene and similar uses...[and] should be free from contamination” (WHO, 2016, p.32). As with sanitation, the SDGs offer a more comprehensive target of “safely managed” which is defined as “drinking water from an improved water source that is located on premises, available when needed and free from faecal and priority chemical contamination” (UN, 2018, p.37). The updated WASH ladders and the corresponding definitions will be referenced in section 2.6 when discussing how climate change resilience can be integrated into WASH interventions.



Figure 6: WASH Ladders (UNICEF Pacific, 2018, p. 35).

2.4.3. Challenges to achieving SDG 6

The literature reviewed highlighted many barriers to increasing access to safely managed WASH services in Fiji. UNICEF Pacific (2018) provides two main categories that this research utilizes to describe the various challenges that have been drawn out of the literature. The social and economic factors that influence access to WASH are discussed below, while the climate and disaster related challenges are addressed in section 2.5. The six social and economic challenges summarised below are selected due to their being cited by numerous sources and their relevance to data collected during the semi-structured interviews. The literature is consistent in emphasizing that climate related threats must be considered alongside the existing non-climate related challenges to implementing WASH services (UNICEF Pacific, 2018; WHO, 2016). Therefore, it is important for this research to provide the following overview of common challenges found in the literature.

Social and Economic

1. As shown in section 2.4.1., there are numerous government institutions responsible for water resource management and WASH services, which results a sectoral approach to service delivery and consequent poor coordination (Batchelor, et al., 2011; SPC, et al., 2003). Furthermore, Chandra (2010), observes that government agencies do not have enough capacity to support projects at the community level. The challenge of coordination of stakeholders is illustrated in the lack of information on existing rural water and sanitation systems (Chaudhury, 2015; GoF, 2017).
2. There has been insufficient attention given to building capacity within communities to manage their WASH systems (Chandra, 2010; Chaudhury, 2015; GoF, 2016; SPC, et al., 2003).
3. WHO (2016) describes the need for greater financial commitments from government and donors, as well as public-private partnerships, to achieve universal WASH coverage in the Pacific. SPC, et al., (2003) and UNICEF Pacific (2018), describe the challenges of financial management and cost recovery that communities face. This is exacerbated by inappropriate technology choices that involve high maintenance and repair costs (Chandra, 2010; WHO, 2016).
4. Another challenge concerning technology choice is that treatment and disposal of excreta are often overlooked and poses huge health hazards to communities through the threat to groundwater and surface water contamination (Batchelor, et al., 2011; Paeniu et al., 2016; SPC, et al., 2003; WHO and SOPAC, 2008). The GoF (2016) highlights the fact that water supply schemes commonly focus on developing one source rather than taking into consideration a utilize a combination of supply options.

5. An increase in poor land use practices that result in higher abstraction rates, pollution, and degradation of water resources (Caritas, 2018; Chandra, 2010; Batchelor, et al., 2011; Gero, 2013; Scott, et al., 2003; WHO and SOPAC, 2008).
6. The remoteness of most rural communities in Fiji creates logistical and financial challenges for the construction and monitoring of WASH systems (Chaudhury, 2015; UNICEF Pacific, 2018). Gero, et al. (2010) notes that the increased financial cost of reaching remote communities discourages government and CSOs from working in these areas.

2.5. Climate change in Fiji

2.5.1 Key Stakeholders

The Climate Change and International Cooperation Division (CCICD) was created in 2012 and sits within the Ministry of Economy (GoF, 2019). This government body is mandated with the coordinating the implementation of the National Climate Change Policy (NCCP) (GoF, 2019). The NCCP describes the central role of local government in tackling climate change due to the great variability of climate-related hazards at this level (GoF, 2019). In response, the GoF (2019, p.80) state that national government stakeholders need to work to support their local level counterparts in setting “NCCP objectives.[based on] bottom-up approach[es]”. The following paragraphs will show that climate-hazards are often in form of disasters in Fiji and therefore it is also important to note the role of Fiji’s National Disaster Management Office (NDMO). The NDMO is responsible for coordinating activities, from the national to local level, in times of disasters (NDMO, 2016).

2.5.2 Climate variability and disasters

Fiji’s climate is influenced by three main factors: The South Pacific Convergence Zone (SPCZ), Trade Winds and El Niño-Southern Oscillation (ENSO) episodes (Terry, 2005; Scott, et al., 2003). Fiji has two distinct seasons. The rainy season lasting November through April the dry season May to October (Terry, 2005). However, the amount of precipitation received varies drastically. Trade Winds bring high levels of precipitation and, on Fiji’s main islands, it is the “southeast sides” that are exposed and therefore “can receive mean annual rainfall in excess of 4000 mm” (Terry, 2005, p.34). However, those regions not exposed to Trade Winds, especially in the “northwest” receive considerably less precipitation annually (Terry, 2005, p. 34). Chaudbry (2015, p.5) points out that “in areas of the Pacific where there are trade winds, precipitation will be more uncertain” and therefore in Fiji this will be an important issue.

Precipitation is also influenced heavily by episodes of El Niño, which lead to “extensive wet and dry cycles” (Scott, et al., 2003, p.5). El Niño is the “term used for the extensive warming of the upper ocean in the tropical eastern Pacific” (Scott et al., 2003, p. 5). In years without strong ENSO activity, rainfall benefits from convection along the low-pressure SPCZ. At the start of El Niño

events, convection storms are generated as the eastward-migrating pool of warm sea surface temperatures passes across northern Fiji waters, but as El Niño conditions fully develop, an equatorward shift in the SPCZ away from the islands leads to prolonged dry conditions” (Terry, 2005, p.34). An important observation by the GoF (2017) highlights that although most droughts in Fiji have been caused by El Niño episodes, not all El Niño events have resulted in droughts. Historically, Fiji has not suffered from “long multi-year drought events [but rather] relatively short, seasonal droughts with an average duration of a few months or less (GoF, 2017, p. 54). Terry (2005, p.38) describes how droughts in Fiji have historically resulted in “critically low stream baseflows”. Paeniu et al. (2016, p.13) describes how lower levels of rainfall also decreases “groundwater supply and contributes to drought conditions that impact agricultural production of major export commodities such as sugar”.

It is important to describe the factors that influence Fiji’s natural climate variability to give context to the complexity of water resources management in the country. However, extreme weather events are given far greater attention in the literature examined. Table 2 shows that droughts, cyclones and floods are the events that have affected the largest number of people in Fiji over the past four decades.

Table 2: The direct impact of major disasters in Fiji between 1970 and 2016 (GoF, 2017, p.48)

DISASTER	NUMBER OF EVENTS*	NUMBER OF PEOPLE AFFECTED*	NUMBER OF PEOPLE KILLED
Drought	6	840,860	0
Tropical cyclone	66	1,888,490	355
Flood	44	563,310	103
Severe local storm	2	8,370	17
Earthquake	10	0	5
Tsunami	2	0	0
TOTAL	130	3,299,030	480

Tropical Cyclone Winston, which hit Fiji in 2016 had “maximum average wind speeds of 233 km/hour, and wind gusts [that] peaked at around 306 km/hour” (GoF, 2017, p.48). Cyclones are not only dangerous due to wind speed, but they also bring high levels of precipitation and storm surges (Scott et al., 2003; Terry, 2005). During TC Winston, some areas were “inundated almost 200 meters inland” by storm surge (GoF, 2017, p. 48). In addition to flooding as a result of storm surge, Fiji also experiences frequent fluvial floods (Terry, 2005). Over the previous four decades, there has been an average of one flood per year in Fiji (GoF, 2017).

2.5.3 Projected climate-induced hazards in Fiji

The existing climate variability and extreme weather events that Fiji has historically been exposed to are already being influenced by climate change (GoF, 2018). However, uncertainty remains about many of the potential climate threats and their impacts, especially at a local scale. (Chaudhury, 2015; Genevaux, 2018; GoF, 2017; Hadwen et al., 2016; Bates, et al., 2008). Batchelor, et al. (2011, p.14) provides an explanation of why the impacts of climate change are challenging to predict:

“the local water balance (how rainfall at a particular place becomes divided between surface water runoff and infiltration, and then between evaporation and groundwater recharge) is very sensitive, not only to changes in climate, but to changes in soil properties, agricultural practices or land use... to make the situation even more complicated, there is the potential for all kinds of feedback loops that have the potential to exacerbate (or possibly reduce) potential climate change impacts... [including] feedback loops from (mal) adaptation measures to climate change”.

The hazards described below are not meant to include all climate-related hazards in Fiji, rather they are listed due to their relevance to WASH, their recognition in the GoF’s 2017 *Climate Vulnerability Assessment* and their consistency with what is described in Chapter 26 of the IPCC’s 5th Annual Report (Nurse, et al., 2014). Additionally, the threats in Box 1 are selected due to their relevance to the interview data.

Box 1: Main climate-related hazards

- Increased severity of tropical cyclones and associated storm surges (GoF, 2017a; Nurse, et al., 2014).
- Rise in sea level, also contributing to increased severity of storm surges (GoF, 2017a; Nurse, et al., 2014).
- “Increase in frequency and intensity of extreme daily rainfall... [leading to an] increase in fluvial floods [and] landslides” (GoF, 2017a, pp.51, 55).
- A rise in average ocean and land temperatures (GoF, 2017a; Nurse, et al., 2014).

It is important to note that the GoF (2017a) concludes that scenarios on how climate change will impact average precipitation levels are not consistent and while the impact of an increase in average rainfall is considered, the impact of an average decrease is not. Furthermore, according to the GoF (2017a, p.54), “the intensity and frequency of drought is unlikely to change dramatically”. While Nurse, et al., (2014) also notes this uncertainty, the potential impact on water resources noted by Bates, et al., (2008) that may arise from a decreased average rainfall

are significant. Therefore, a decrease in average precipitation is included in this research as a key hazard.

As illustrated in Figure 1, each hazard has an impact on water and sanitation, which creates risk to communities (G nevaux, 2018). The following paragraphs will summarise the key impacts, the hazards they are linked to and describe the resulting risk to communities.

2.5.4 Impact of climate-induced hazards on water supply

Saltwater intrusion is a potential impact from tropical cyclones and sea level rise (Caritas, 2018; Chui and Terry, 2015; Nurse, et al., 2014). As groundwater becomes increasingly saline, it will reach a point where it is not safe to drink (G nevaux, 2018). Furthermore, G nevaux (2018), notes that saltwater intrusion can cause infrastructure to rust. Alternatively, Scott et al. (2003) describes the impact of storm surges, where it can take months for inundated freshwater to become safe to drink again. The resulting risk to communities is a “decrease of freshwater availability for humans.... in coastal areas” (Nurse, et al., 2014, p.3).

An additional impact on groundwater resources is from a rise in periods of intense precipitation. Large volumes of rainfall in short periods of time can result in a lower absorption into soils and thus groundwater recharge (Batchelor, et al., 2011). Increased runoff can also impact surface water through the transportation of pollutants and greater turbidity (G nevaux, 2018). Along with greater rainfall intensity, Bates et al. (2008) describes how surface water quality can also be impacted by increasing temperatures and extended periods of little precipitation as pollutants will become more concentrated as the flow and volume of water decreases. The GoF (2017a) refers to specific concerns over an increase of diarrhoeal disease, typhoid fever, dengue fever and leptospirosis that have been linked to a rise in temperatures and intense precipitation. G nevaux (2018) explains that the change in quantity or quality of water can impact WASH services as systems may not be designed to treat the increased level of contaminants or changes in flow. Therefore, the major risk to communities posed by increased rainfall variability and rising temperatures are a decrease availability of safe drinking water (G nevaux, 2018).

Tropical cyclones and floods will have similar impacts on water quality and quantity to those discussed in the previous paragraphs. In addition, these hazards impact infrastructure by damaging water supply and sanitation systems (Bates, et al., 2008; Batchelor, et al., 2011). G nevaux (2018) explains that systems which rely on electrical equipment are particularly vulnerable. Additionally, G nevaux (2018) raises the important point about the impact on access to communal water points that floods can have. Damage to infrastructure also results in risk to communities in the form of decrease access to safe water supplies (G nevaux, 2018).

2.5.5 Impact of climate-induced hazards on sanitation

There is a large focus on how climate change impacts water in the literature but there is considerably less written on the impacts to sanitation. For example, Bates et al., (2008, p. 128) simply states that “climate change is expected to exacerbate problems of access at a household level”. Similarly, Batchelor, et al. (2011) describes how climate change has an indirect impact on sanitation as competing demands for water grow. G nevaux (2018) is the only source that describes in detail the potential impacts of different climate hazards on sanitation. Droughts, an increase in average temperatures and precipitation variability can lead to “biological treatment processes fail[ing] to function” (G nevaux, 2018, p. 27). Furthermore, cyclones and floods can damage infrastructure and cause treatment systems to “fail... due to hydraulic overload” (G nevaux, 2018, p. 27). If sanitation systems are damaged or cease to function, there are multiple risks health and environmental risks to communities. Untreated wastewater released into the environment can contaminate water sources and increase the risk of waterborne diseases (G nevaux, 2018).

2.5.6 Social impacts of risks to WASH as a result of climate change

There are already large existing disparities between rural and urban WASH coverage and climate change is predicted to exacerbate these inequalities by disproportionately impacting “rural communities with low socioeconomic status reliant on water resources for their livelihoods” (WHO, 2016, p. 58). The GoF (2017a) shows that this is also the case in Fiji, as poor households have fewer resources to prepare and respond to the hazards of climate change. Further potential social challenges that may occur as a result of climate change include increased conflict over water resources, within and between communities but also between sectors (Batchelor, et al., 2011). Hadwen et al. (2016) also emphasized the social impact of forced migration, as communities’ traditional water sources are threatened.

2.6. Integrating climate resilience into WASH interventions

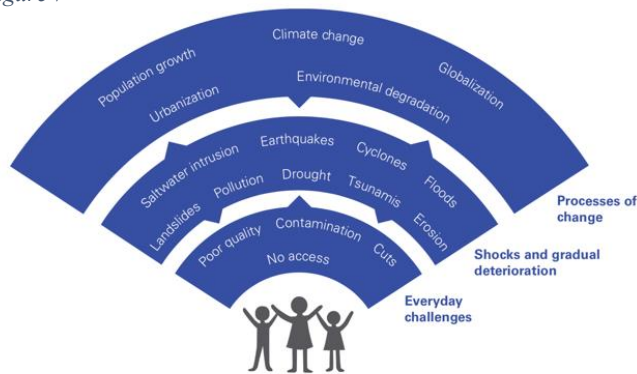
This section will compare the literature that focus on integrating climate change resilience and WASH at the community level. With the aim of clarifying what different sources have written on implementation at the community level, this section is divided into assessment and identification, planning and implementation, monitoring and funding. The debate on distinguishing between development and climate change resilience that G nevaux (2018) refers to will help to frame the discussion in the paragraphs below.

2.6.1. Assessment and Identification

The impacts of climate-induced hazards and the resulting risk to communities listed in section 2.5 are important to provide context for discussing what the literature says regarding how WASH programs and projects address these impacts. As previously mentioned, when discussing key concepts, holistic risk assessment emerged as a common theme in the literature. Gero et al.

(2013) describes how Vulnerability and Capacity Assessments (VCA) are already in use in DRR and CCA sectors as a tool for assessing risks to communities. However, Batchelor, et al. (2011, p.8) points out that “the WASH sector has been slow to adopt and mainstream...tools for prioritising and managing risk and uncertainty”. A counter argument to the observation by Batchelor, et al. (2011) is the use of Water Safety Plans (WSPs) (Deere, et al., 2017; GoF, 2018b). Deere, et al. (2017) describes how WSPs are used to consider potential future risks to WASH systems. Deere, et al. also

Figure 7



notes that WSPs can also help communities manage the risk of disasters by developing “contingency planning [and] control measures that help protect water supplies... [that] build upon broader improvements in water resources management (Deere, et al., 2017). Indeed, WSPs are promoted in the GoF’s *Practical Guidelines for Rural Water*

Supply Management Plan. UNICEF Pacific (2018b), goes further by providing practical guidance to integrating climate hazards into WSP with the development of Drinking Water Safety and Security Planning (DWSSP). Figure 7 shows the relationships between the different risks that result from “everyday challenges... shocks and gradual deterioration...[and] processes of change” (UNICEF Pacific, 2017, p. 6). UNICEF Pacific (2018) states that before addressing risks that arise from climate change, it is necessary to establish that WASH systems, both software and hardware components, can manage those that result from everyday challenges. By using such an approach, UNICEF Pacific (2018) makes a clear distinction between development activities and climate change adaptation, which links to the debate highlighted by G nevaux (2018) and discussed in section 2.3.4.

DWSSP and WSPs use health risks as an entry point to working with community and motivating change (UNICEF Pacific, 2018; WHO, 2009). However, Deere, et al. (2017, p. 30) conceded that this emphasis on health often means “not all catchment management issues can be feasibly considered within the scope of a WSP”. Further shortcomings of WSPs are noted by String et al. (2017), who carried out an assessment of WSP’s in four countries, including Fiji. A challenge of WSPs is that to continually manage risk, they stipulate the importance of water quality testing to monitor the health risks to systems, however; in reality regular testing does not occur and String, et al., describes that there have been “no improvement in microbiological water quality in villages (2017, p.5). Finally, the “complexity of WSP is a barrier to implementation... [and] tools for risk identification and assessment” (String, et al., 2017, p. 5).

Another method of risk assessment and management identified in the literature reviewed is described by Batchelor, et al. (2011). Rather than just one tool, such as DWSSP, Batchelor, et al. (2011, p. 33) suggests a range of thirteen tools for “identifying, prioritising and managing risk and uncertainty” in WASH planning. However, while the tools that Batchelor, et al. (2011) describe have similar goals of identifying and managing potential risks to WASH systems, they do not make the clear distinction between development activities and climate change adaptation that DWSSP provides. Batchelor, et al. (2011) describes how each tool fits within a certain phase of the project management cycle. However, when compared to the guidance the WHO (2009) gives for developing WSPs, the tools Batchelor, et al. (2011) describe, is less structured. String et al. (2017) have provided evidence that WSPs can be challenging to implement due to their complexity, which implies that the toolbox that Batchelor, et al. (2011) propose may be even less practical.

A common theme in WSP, DWSSP and Batchelor, et al. (2011)’s toolbox is building the management capacity of communities through participatory approaches to risk assessment (Deere, et al., 2017; UNICEF Pacific, 2018). Community participation in the risk assessment process supports the premise, discussed in section 2.3.3, of avoiding top-down labelling of vulnerability that can result in external dependency. Furthermore, the literature is consistent that bottom-up approaches that encourage community ownership are good practice for resilience work (Batchelor, et al., 2011; Deere, et al., 2017; Dumar, et al., 2011; Kelman and West, 2009). Janif, et al. (2016) add that community participation is necessary to the sustainability of projects due to insufficient government resources to support donor-funded activities when the funding expires. However, the assessment tools discussed above do not specifically address the value of communities’ traditional knowledge of risk management that is emphasized in other literature sources (SPC-FRDP, et al., 2016; Gero et al., 2013; Kelman and West, 2009). Gero, et al. (2013, p.108) makes a critical observation that “there is no Fijian word for ‘vulnerability’ – the closest word translates to ‘weakness’”. Gero, et al. (2013) stresses that this should not be interpreted as a lack of understanding of vulnerability in communities. Traditionally, Fijian communities have a close relationship to the environment and have signs that indicate when extreme weather, such as a cyclone, will occur (Janif, et al., 2016).

2.6.2. Planning and Implementation (make sure to discuss traditional methods)

Once risks have been identified and prioritized, the next step in the project cycle to building climate-resilient WASH, is determining how to manage risks and how to implement these measures. The literature reviewed shows that climate-related risks can be managed through adaptation or mitigation (G nevaux, 2018; SPC, et al., 2016). However, mitigation in the context of climate change “focuses on... reducing greenhouse gas emissions” (G nevaux, 2018, p.31). While water and sanitation systems can emit carbon, at the community level in rural Fiji this is minimal

and thus only adaptation methods will be discussed below (UNICEF Pacific, 2018). UNICEF Pacific (2018) explains how in WASH programs that are focused on development, sustainability depends on infrastructure and community management capacity and these two components remain essential for climate-resilient WASH.

2.6.2.1 Infrastructure

The literature is consistent in recommending that WASH infrastructure should be built according to ‘no regret options’ and ‘build back better’ notion, as outlined in the Sendai Framework for Disaster Risk Reduction (Bahadur, et al., 2014; G nevaux, 2018, p. 37; SPC, et al., 2016, p.10; UNICEF Pacific, 2018). Furthermore, “incorporating climate risk management into infrastructure planning and design is critical” to the resilience of the systems (Hurford, et. al., 2017, p.4). The design life of WASH systems varies from ten to twenty-five years (Smet and van Wijk, 2002, p.67). The potential for these time scales to change to enable systems to be more adaptive may be an important consideration in future planning (Howard and Bartram, 2010, pp.5-6). While it is accepted that appropriate infrastructure varies with the location of communities, UNICEF Pacific (2018, p.42) argues “that government has a role to play in establishing standards for infrastructure and appropriate technology”. However, the GoF (2017a) reveals that the Fiji National Building Code is difficult to enforce in large part due the lack of awareness at the local level.

The literature offers contrasting views of what would be more resilient with respect to the organization of WASH systems. Firstly, one study showed that centralized water supply and sanitation systems are more resilient to climate hazards because they have better access to resources and thus can recover from shocks faster (Luh, et al., 2017). However, Bahadur, et al. (2014, p.10) calls for “decentralization of service delivery by supporting small water and sanitation enterprises to improve access to water and sanitation and local livelihoods. Howard and Bartram (2010) proposed a combined management approach, explaining that decentralizing management with continue centralized oversight. Referring back to the discussion on stakeholders in rural WASH shows that rural WASH in Fiji is decentralized and ,in theory, supported centrally. However, as previously mentioned by Janif, et al. (2016), local government often lacks the resources to offer regular, long-term support to rural areas.

With reference to appropriate technology, Luh, et al. (2017) shows that there is no one water supply or sanitation system that is resilient to all of the hazards of climate change. Rather, resilience of a system depends on what hazard is faced (G nevaux, 2018). Table 3 is based on Luh, et al. (2017) and describes the resilience of WASH systems to the key climate-related hazards discussed in section 2.5.3. Luh, et al. (2017) rates the resilience of WASH systems on a scale from one to ten, with ten as the most resilient. To provide a clear comparison, Table 3 utilizes these scores rounded to the nearest whole number. The types of water supply systems listed are based on those discuss by

UNICEF Pacific (2018) for their relevance to rural Fiji. In regards to sanitation systems, a search of the literature did not yield any data on common systems used in rural areas of Fiji. Therefore, the sanitation systems listed are based on those recommended in the *Practical Guidelines For Rural Water Supply Management Plan* (GoF, 2018b). However, while GoF (2018b) lists wetlands and soak pits as treatment methods, Luh et al. (2017) does not provide an analysis of these systems so they are excluded from Table 3.

System	Impact of climate-related hazard			
	Strong wind from tropical cyclones	Salt water intrusion	Flooding	Drought/ low precipitation
Rainwater Harvesting	4	10	8	2
Gravity-fed system from spring source	8	8	6	4
Gravity-fed system from surface water source	6	6	4	5
Borehole	6	4	8	6
Hand-dug well	8	3	5	4
Compost toilet	7	No data	6	10
Pour flush toilet to septic tank	7	No data	4	9

Howard and Bartram (2010) make the important observation that the ability of a system to resist or adapt to a hazard depends on its various components and the more parts a system has will either increase or decrease its resilience depending on their quality and design. This is a critical point that emphasizes the need for a thorough understanding of the project context for existing systems and the concomitant risks. The first part of a water supply system is its source (Smet and van Wijk, 2002). Therefore, ensuring water sources are protected is “the first critical step in

enhancing resilience” (Howard and Bartram, 2010, p.12). Groundwater sources are considered more resilient to floods and droughts than surface water but are less resilient to saline intrusion (Luh et al., 2017). However, the resilience of dug wells and boreholes depends on their depth since those that are above the water table are far less resilient than those below the water table (Luh, et al., 2017). Furthermore, Howard and Bartram (2010, p.14), state that floods represent a substantial hazard to boreholes that do not have elevated “wellheads... screens... [or] impermeable casing”. A similar conclusion is drawn regarding spring sources, where resilience to floods “also depends on how well the spring is protected” (Luh, et al., 2017, p.340). As different water sources are vulnerable to different hazards, a common recommendation is to use multiple water sources together so that if one source is compromised, a community can still access safe water. (Bahadur, et al., 2014; Deere, et al., 2017; G nevaux, 2018).

After a source protection, another important component of a water supply system is the treatment processes employed. Depending on the type of hazard, treatment can either increase or decrease the resilience of the system. The scores given to gravity-fed systems from surface water are those that Luh, et al. (2017) allocated to systems with treatment. The reason for this is to meet the requirements for a basic level of service laid out by the United Nations (UN) (2018). A system that has a treatment component will be more resilient to changes in water quality that arise from droughts or floods, assuming the treatment processes are designed to manage these changes (Howard and Bartram, 2010). Conversely, small systems with no treatment have no means of managing the fluctuations in water quality and thus are less resilient (Howard and Bartram, 2010). However, Howard and Bartram (2010) do not consider the hazard of cyclones that could cause a system’s loss of power. In this case, simpler systems that require no power or can function from generators are more resilient (Luh, et al., 2017). For example, groundwater sources that use manual lifting devices and do not require treatment have a high resilience (Luh, et al., 2017, p. 341). Rainwater harvesting, which is one of the most common supplies of safe drinking water in many Pacific islands (WHO and SOPAC, 2008), is rated as having relatively low resilience because it is susceptible to wind damage and droughts (Luh, et al., 2017). However, Luh, et al. (2017) noted that resilience is also influenced by the storage capacity of the system. Deere, et al. (2017) emphasize that designing storage capacity of water supply systems should consider the potential increases in variable precipitation or ensure that systems can be easily and cheaply adapted to manage changes.

Table 3 only includes on-site sanitation systems, as this is the type commonly found in Fiji (GoF, 2017a). However, Luh, et al. (2017) does not include wetlands or pour-flush toilets in their evaluation of resilient WASH systems, nor do they discuss the impact of saltwater intrusion. The major comparison between sanitation systems is between wet and dry technologies. Luh, et al., (2017) emphasized the resilience of compost toilets because they do not rely on a water supply to

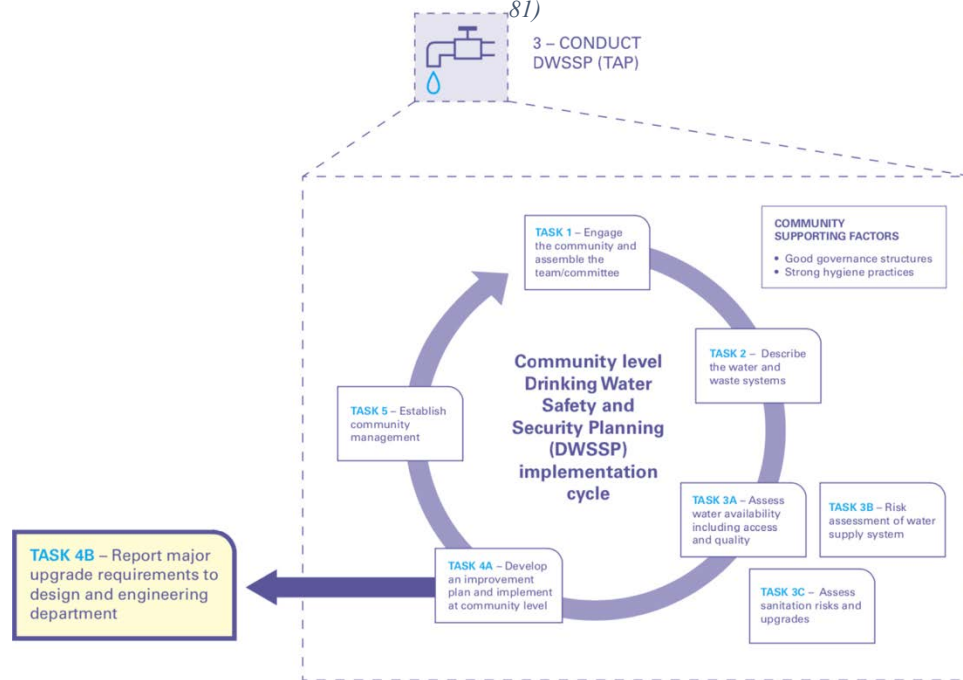
function. Another benefit of compost toilets is illustrated by WHO (2016, p.58) who describes that their use in Tuvalu, resulted in “reductions in sewage pollution to groundwater and coastal water, reduction in the use of fresh water for toilet flushing, and generation of organic matter” for farming. Howard and Bartram (2010, p.18) consider that “it may be more appropriate to build low-cost temporary sanitation facilities that can be easily moved and re-built”. However, this approach to resilience is not discussed by other sources that consider infrastructure options, such as, Luh, et al. (2017), G nevaux (2018), or UNICEF Pacific (2018).

A further issue identified in the literature review is the gap in the use of ecological solutions to build climate-resilience. The WHO and SOPAC (2008, p.39) recommends utilizing IWRM to guide hardware choices and provides an example project where “constructed wetlands” were used to manage excreta. Bahadur, et al. (2014, p.10), briefly recommends the use of “recycled water systems”. G nevaux notes that “nature-based solutions” should be considered when building resilience to an “increase in the frequency and intensity of extreme weather events, [such as] intense rain events” (2018, p. 45). G nevaux (2018, p. 52) describes how “nature-based solutions are often well suited to these integrated approaches and can provide an alternative technological investment or infrastructure construction and maintenance that is economically viable and sustainable and often more cost-effective over the long-term”. G nevaux’s comments demonstrate a gap in the other literature reviewed with respect to guidance on hardware solutions. A comparison of the brief discussions by WHO and SOPAC (2008), Bahadur, et al. (2014) and G nevaux (2018) with Luh, et al., (2017), Howard and Bartram (2010) or UNICEF Pacific (2018), shows that these sources have not given consideration to ecological solutions to creating resilience.

2.6.2.2 Community Management

Assessing how resilient different technologies are to climate hazards is only one part of determining appropriate technology. The second factor in technology choice is community management capacity (Smet and Wijk, 2002). It is well proven in the WASH sector that involving communities in choosing technology will help ensure that the chosen technology is appropriate for the skills and preferences of the users (Smet and Wijk, 2002; sanitation one). Indeed, the GoF (2018a, p.79) lists “build[ing] the capacity and responsibility of communities... to manage risks to water and sanitation” as one of the adaptation measures for water and sanitation. However, as Batchelor, et al. (2011, p.26) explains, “carefully-targeted communication and awareness raising programmes are needed... to highlight comparative benefits to these technologies”. UNICEF Pacific (2018) draws attention to the fact that Pacific communities have existing management structures that should be utilised. This is supported by the GoF’s (2016) *Rural Water and Sewerage Policy* that mandates all WASH projects to work with community development committees or, if established, community water committees.

Figure 8: Tasks involved in the DWSSP approach (UNICEF, 2018, p. 81)



As with risk assessments, WSPs and DWSSPs provide proven frameworks for building community management capacity (Deere, et al., 2017; UNICEF Pacific, 2018). Communities are involved in every step of the process that is illustrated in Figure 7. WSPs do not explicitly provide guidance on climate change (WHO, 2009). However, DWSSPs fill this gap by integrating climate resilience into trainings through climate and disaster related risks and recommendations for modifications for resilient infrastructure (UNICEF Pacific, 2018). Conversely, G nevaux (2018, p.35) describes involving communities in climate-resilient WASH interventions as a key “challenge when designing intervention”. While G nevaux (2018) emphasizes the importance of community participation, especially for vulnerable groups and the acknowledgment of traditional knowledge, there is no specific guidance on practical approaches to achieve this. Rather, G nevaux (2018, p.65) recommends utilizing existing approaches, such as WSP and IWRM “to inform the development of appropriate and sustainable responses”.

IWRM is another common approach to address climate-resilience that was identified in the literature. The WHO (2016, p.59) defines IWRM as “a process which promotes coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems”. Deere, et. al. (2017, p.19) describes that DRR is required to address the threat of increased severity and frequency of extreme weather but IWRM can offer the “framework for adaptation to the long-term changes associated with climate change”. The literature also provides some examples of practical application of IWRM to community management:

- Fair distribution of water resources for domestic, economic and ecosystem services (G nevaux, 2018).
- Diversifying water supplies to limit scarcity (Mukheibir and Boronyak-Vasco, 2016).
- Promoting water re-use and demand management strategies (Bahadur, et al., 2014; WHO and SOPAC, 2008)
- Considering methods for protecting whole catchment areas (Howard and Bartram, 2010; Overmars and Gottlieb, 2005)

UNICEF Pacific (2018) provides a framework for integrating IWRM into the DWSSP approach; however, it is not discussed in any detail and is set within a policy context rather than applicability to community management. Additionally, Deere, et al., (2017, p.22) points out that “many IWRM tools relate to the institutional and governance arrangements for water management rather than direct control measures”. Overmars and Gottlieb (2005) and Hadwen, et al. (2016) describe that there remains a large gap in effectively utilizing IWRM in the Pacific. However, Hadwen, et al. (2016) does point to Ridge-to-Reef projects that have utilized IWRM successfully as framework to help communities manage their land, water and marine resources.

While numerous sources recommend WSP or IWRM (Deere, et al., 2017; G nevaux, 2018, GoF, 2019; GoF, 2018a, GoF, 2018b; UNICEF and GWP, 2014; WHO and SOPAC, 2008) they do not offer an evidence-based analysis of the effectiveness of the approaches. Fortunately, String, et al. (2017) fills some of this gap. String, et al. (2017) describes that while WSP have shown to be effective in increasing the management capacity of some communities, one of the main challenges is the time required to complete the relatively complex trainings (String, et al., 2017). Furthermore, as Batchelor, et al. (2011) emphasizes, it cannot be assumed that WASH professionals have sufficient training and knowledge on climate change and resilience to provide guidance to communities. Therefore, GWP and UNICEF (2014) suggest a crucial part to building community management capacity is building capacity within the WASH sector to manage climate-related risks.

The discussion in section 2.4.1 regarding stakeholders in the rural WASH sector shows the role governments and CSOs have in offering ongoing support to community management. It is important to reiterate (Janif, et la., 2016) the observation about the challenges that government stakeholders have in reaching rural communities to monitor systems and provide support to community management.

G nevaux (2018) discusses that monitoring frameworks should include indicators that reflect climate change. While UNICEF Pacific (2018) lists only water quality as an indicator for monitoring service, G nevaux (2018, p.43) also includes “the level of the water table, the quality of the wastewater discharged into the environment, and the frequency of service interruptions linked to climate-related hazards”. However, as WHO (2016, p.36) states, the SDG indicators are already

challenging enough to monitor due to the absence of “baseline data and national monitoring and reporting systems”. This is supported by the GoF (2017a) that admits information on rural WASH systems in Fiji is a key barrier to adaptive planning.

2.6.2.3. Funding

The literature reviewed highlights the debate surrounding climate financing and how this influences community management. UNICEF Pacific (2018) describes the challenge communities face in financing infrastructure improvements and the need for some form of external assistance. However, the evaluation by String, et al. (2017) shows that although WSPs involve identifying infrastructure improvements, they do not provide guidance on financing these improvements. UNICEF Pacific (2018) stipulates that financial assistance should only be provided to communities who have proven capacity to manage their WASH systems and have attempted to utilize everything within their means to address the challenges without external assistance. UNICEF Pacific (2018, p. 36) provides a practical solution in the form of “a capital assistance programme (CAP)” that should be focuses specifically on building resilience. As such, UNICEF Pacific (2018) suggests CAP funding could be used for assessing climate-related risks to WASH systems or infrastructure upgrades, while recommending on-going operation and maintenance (O&M) costs and salaries be excluded.

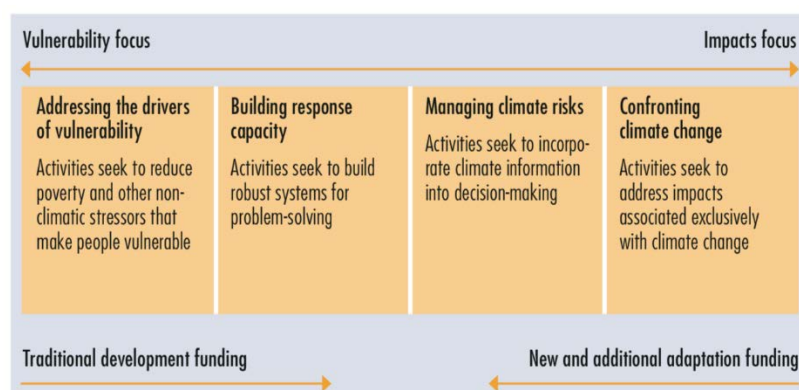


Figure 9: “Adaptation continuum” (G nevaux, 2018, p.32).

G nevaux (2018) provides a useful diagram that differentiates between funding for development activities and activities that focus on adaptation measures. While UNICEF Pacific (2018), emphasizes funding for climate resilience should only be provided to communities with existing services and functioning management, other sources do not make this distinction. While SPC, et al. (2016) and G nevaux (2018) discuss climate financing available from international donors they do not address the potential dependency that external financing can create. It is important to reiterate Kelman’s (2018) point concerning the detrimental effect of labelling a community vulnerable and how proceeding with external assistance can lead to reliance on this support, thus undermining the sustainability of any interventions. This is particularly relevant to the

WASH sector, as has been illustrated in previous paragraphs there is a large overlap between what constitutes WASH, CCA and DRR. The main issue being that climate adaptation in the Pacific is largely seen as the responsibility of international stakeholders, those high emitting countries who have a responsibility to cover the costs faced by island communities already seeing the impacts of climate-related hazards. However, in the WASH sector, it is well proven that externally financed projects pose major challenges to sustainability of community management.

Another interesting point that emerged from the literature reviewed on funding climate change adaptation in the WASH sector is the role of the private sector. The GoF (2018a) describes both the financing and construction gaps that could be filled by the private sector. Looking at the community level specifically, Bahadur, et al (2014, p.10), notes the need for “small water and sanitation enterprises to improve access to water and sanitation and local livelihoods”. However, aside from these sources, the remainder of the literature did not describe the potential for the private sector to help in building climate-resilient WASH.

2.7. Conclusion

The following paragraphs will identify the key learnings that have helped to fulfil the below objectives. Additionally, gaps within each of these objectives are identified to justify the research.

- Objective 1: To assess Fiji’s WASH sector;
- Objective 2: To determine key climate-related threats to WASH in rural Fiji;
- Objective 3: To identify good practice approaches to climate-resilient WASH;
- Objective 4: To present recommendations based on comparisons made between interventions in Fiji and those identified in the literature reviewed.

2.7.1 Fiji’s rural WASH sector and current access

2.7.1.1 Learning

The literature reviewed revealed that there are numerous stakeholders involved in rural WASH in Fiji. Rural communities are ultimately responsible for their own WASH services, which are managed through community development committees or water committees (GoF, 2018b). While there are good mechanisms in place to support access to rural WASH, the literature highlights that there are challenges when it comes to the practical application of the management of rural WASH services (Batchelor, et al., 2011; Chandra, 2010; Chaudhury, 2015; GoF, 2016, GoF, 2017; SPC, et al., 2003; UNICEF Pacific, 2018; WHO, 2016). Rural communities often lack the capacity to manage their WASH services without consistent external support (Chaudhury, 2015; Gero, et al., 2010; UNICEF Pacific, 2018). However, the remoteness of communities is noted as a major problem for the ability of both governments and CSOs to provide this support. Furthermore, inappropriate technology, little or no cost recovery, and poor land use practices contribute to

management challenges (Batchelor, et al., 2011; GoF, 2016; Paeniu et al., 2016; SPC, et al., 2003; WHO and SPC, 2008). While WASH coverage in rural areas is said to be relatively high, comparing the terms used in the literature shows the importance of recognizing the difference between MDG and SDG definitions. This is an especially important issue in sanitation, as a basic level does not clarify if excreta is safely disposed of, and this can lead to groundwater contamination, and other health and environmental hazards (UN, 2018).

To compound this issue of changing definitions, the Government acknowledges that data on rural WASH is limited, therefore putting into question whether rural areas have access to even basic services (GoF, 2017a). The literature states that climate change will exacerbate existing challenges to rural WASH access and emphasizes the importance of understanding these challenges in order to effectively address climate-related risks (WHO, 2016).

2.7.1.2 Gap

While the types of WASH systems are generally described as on-site there is limited literature on the specific schemes commonly used in rural communities (GoF, 2017a). The GoF (2017a) states that this is a major barrier in being able to provide climate-resilient planning. This research will aim to address this gap by asking key what water supply and sanitation systems are used in their projects' target communities.

2.7.2. Climate-related hazards to rural WASH services

2.7.2.1 Learning

The literature shows consistency in emphasizing the existing climate variability in Fiji (Chaudhury, 2015; Scott, et al., 2003; Terry, 2005). Climate change is predicted to exacerbate this variability; however the literature acknowledges the challenges in making reliable predictions about what this will look like (Chaudhury, 2015; G nevaux, 2018; GoF, 2017; Hadwen et al., 2016; Bates, et al., 2008). The difficulty in making predictions is even more pronounced at the local scale (Nurse, et., 2014). However, the literature that emphasized the value of local knowledge and participation in assessing climate-related threats, helps to fill the gap in scientific knowledge (Kelman and West, 2009). An increase in extreme weather events, namely tropical cyclones and floods, are given the greatest attention by the Government (GoF, 2017a). This is assumed to be due to their historical significance in Fiji and the greater certainty of the predictions in the scientific data (GoF, 2017a). Many of the literature sources describe how climate-related hazards impact water resources (Bates, et al., 2008, G nevaux, 2018; Howard and Bartram, 2010; UNICEF Pacific, 2018). However, when comparing the detailed description of risks given by G nevaux (2018), it shows the gap how other sources describe the impact on water resources will also impact water supply and sanitation services and the resulting health, environmental and social risks to communities. One of the largest impacts to communities is a decreased quantity and quality of water supply either as a result of periods of low or intense rainfall or damage to infrastructure from

cyclones (Bates, et al., 2008; G nevaux, 2018). Additionally, flooding can impact sanitation systems that use pits, soak pits or septic tanks to treat excreta (G nevaux, 2018).

2.7.2.1 Gap

The literature describes how local perspectives on climate change are often overlooked. This research aims to fill this gap by speaking with stakeholders who work directly with communities and thus have an in-depth understanding of the local context and can share their opinions on climate-related threats.

2.7.3 Climate-resilient WASH activities

2.7.3.1 Learning

When reviewing the literature on climate-resilient WASH, it became apparent that how activities were classified as climate resilient was not always clear. It is important to re-state this research investigates the resilience of rural WASH rather than simply their adaptive capacity. Resilience includes transformational change, which involves moving being the ability to absorb and adjust to shocks (Béné et al., 2012). UNICEF Pacific (2018, p.6) argues that WASH projects must first address the “basic challenges” to achieve a basic level of service. This is supported by G nevaux (2018, p.32) who uses an “adaptation continuum” to illustrate that activities should first focus on addressing barriers to WASH services that are not related to climate change. Both G nevaux (2018) and UNICEF Pacific (2018) describe how understanding the existing challenges that are not caused by climate change will enable the community to strengthen its management capacity and thus provide a solid foundation on which to include climate-induced risks. This process is further supported by the literature that observes how climate-related hazards exacerbate existing barriers to rural WASH access (WHO, 2016).

It follows that robust processes for risk assessments are required to identify and prioritize risks to rural WASH (Batchelor, et al., 2011; Deere, et al., 2017; G nevaux, 2018; UNICEF Pacific, 2018). If processes are not in place to identify the root cause of a risk, it may be classified as caused by climate change when in reality climate change is only exacerbating it. The literature shows numerous vulnerability assessments that are utilized in DRR and CCA projects although these two agencies do not place the same importance on separating development activities (Gero, et al., 2013). However, there is little evidence on how these are used to inform projects that target community water and sanitation. Alternatively, Water Safety Plans identified by (Deere, et al., 2017) provide a good framework for how a community can achieve and sustain a basic level of service. String, et al. (2017) provides evidence that supports the effectiveness of WSPs, but also highlights the challenges to using them to incorporate climate-related threats. UNICEF Pacific (2018) acknowledges this gap has developed Drinking Water Safety and Security Plans to explicitly consider climate change in supporting communities to achieve basic services. UNICEF Pacific (2018) describes that once a basic level of services is achieved through DWSSPs, a community can incorporate IWRM

processes into planning and management and work towards infrastructure improvements that meet the SGD standards of safely managed services.

A comprehensive evaluation of the resilience of common WASH infrastructure is offered by Luh, et al. (2017). Luh, et al. (2017) is sceptical of the resilience of community managed systems due to their lack of resources relative to government and the private sector. However, as Batchelor, et al., (2011), Chandra (2010), Chaudhury (2015), G nevaux (2018), Howard and Bartram (2010), UNICEF Pacific (2018) describe, community management is critical to resilience. This is especially true in Fiji due to the organization of the WASH sector and responsibility that is given to communities (GoF, 2018b). However, appropriate technology choice remains a fundamental part of building resilience to climate change (G nevaux, 2018, Howard and Bartram, 2010; UNICEF Pacific, 2018). This discussion draws upon the previously discussed distinction between basic and safely managed services.

An important aspect of Luh, et al.'s (2017) evaluation is the higher resilience given to systems that satisfy the criteria for a safely managed classification. This is supported by the fact that climate-related hazards will impact water quality (Bates, et al., 2008). Therefore, systems that involve treatment and are designed to manage fluctuations in water quality can contribute to resilience. This provides an important example of what the literature suggests in regards to designing no or low-regret options (Bahadur, et al., 2014; G nevaux, 2018, p. 37; SPC, et al., 2016, p.10; UNICEF Pacific, 2018). As the predictions around variable precipitation are unclear, it follows that systems should be designed to deal with a wide range of fluctuations in water quality. Luh, et al.'s (2017) evaluation also shows the importance of understanding the specific climate-related hazards in an area in order to select the most resilient technology. Luh, et al.'s (2017) evaluation does not include all systems that are recommended by the Department of Water and Sewerage for rural communities (GoF, 2018b). However, one conclusion that can be drawn from the options that are examined, is the overall higher resilience of compost toilets than flush or pour-flush toilets that use septic tanks (Luh, et al., 2017). This is an important conclusion that is supported by the G nevaux (2018) who calls for the use of nature-based solutions. Technologies that utilise ecological processes support the principles of IWRM that focus on demand-management and water re-use (Bahadur, et al., 2014; WHO and SOPAC, 2008).

A final key theme that emerged from the literature is the role of funding in climate-resilient WASH. Funding for infrastructure and infrastructure improvements is the focus of this discussion. In comparing UNICEF Pacific's (2018) recommendations for climate financing with other sources that discuss climate-resilient WASH (Batchelor, et al., 2011; G nevaux, 2018; Howard and Bartram, 2010) it highlighted a gap in the consideration that is given to this topic. While there is consensus in the literature that community participation and management is essential for building

resilience to climate change, the way capital assistance is provided has a major influence on community ownership and thus sustainability of management (Genevaux, 2018; Howard and Bartram, 2010; Janif, et al., 2016; UNICEF Pacific, 2018). Smet and Wijk (2002) show that projects that provide infrastructure which is exclusively funded externally can create dependency on external support. This observation is critical to the observations by UNICEF Pacific (2018) and Genevaux (2018) on distinguishing between activities that address non-climate related challenges and those caused by climate change. Therefore, if climate financing is used to address the daily challenges a community faces, there is a danger that it undermines a community's capacity to problem solve and thus its ability to manage the larger challenges related to climate change.

IWRM is a concept that was discussed by numerous sources in reference to climate change resilience (Deere, et al., 2017; GoF, 2018a; Hadwen, et al., 2016; Overmars and Gottfried, 2005; UNICEF Pacific, 2018; WHO, 2016; WHO and SOPAC, 2009). However, the literature offers only a few practical examples of its application at the local level and these are project based rather than sustainably integrated into long term programmes (Overmars and Gottfried, 2005; WHO and SOPAC, 2009). IWRM is critical for achieving transformational change as it will require a fundamental change in water resource management and the infrastructure used (Hadwen, et al., 2016; Overmars and Gottfried, 2005). The research will attempt to address the gap of practical application of IWRM during the interview process.

2.7.3.2 Gap

The major gaps, identified in the literature discussed above are as follows. The ability to identify climate resilient activities at the local level. In particular, how IWRM principles and processes help community management reach a safely managed service level. Furthermore, as UNICEF Pacific (2018) acknowledge, hardware approaches are given less focus than community management. Additionally, there is little discussion on the use of nature-based solutions to build resilience in communities (Genevaux, 2018). Finally, the issue of how capital assistance is given to communities, who do not yet have a basic level of service in place, is not discussed outside of UNICEF Pacific (2018). Therefore, this research will aim to address these gaps identified in the literature during the interview process.

3. Methodology

3.1 Description

3.1.1 Qualitative research

A qualitative research style is most appropriate for this research as the aim is to understand climate-resilient WASH interventions in Fiji from a local perspective, thus relying on words and opinions drawn from the data collected (Bryman, 2016; Denscombe, 2017). Furthermore, qualitative

research was chosen due to the relatively small-scale of the research (Denscombe, 2017). Qualitative research is also more appropriate given that this research is attempting to understand the relationship between WASH, DRR and CCA at a community level, which requires a “holistic perspective (Denscombe, 2017). This research utilises interpretivism as it is based on the stakeholders’ own experiences with climate change in Fiji and their work, placing emphasis on learning through analyzing the perspective of others (Bryman, 2016; Denscombe, 2017). This research follows the general process of qualitative research that Bryman (2016) describes in Figure 9 below.

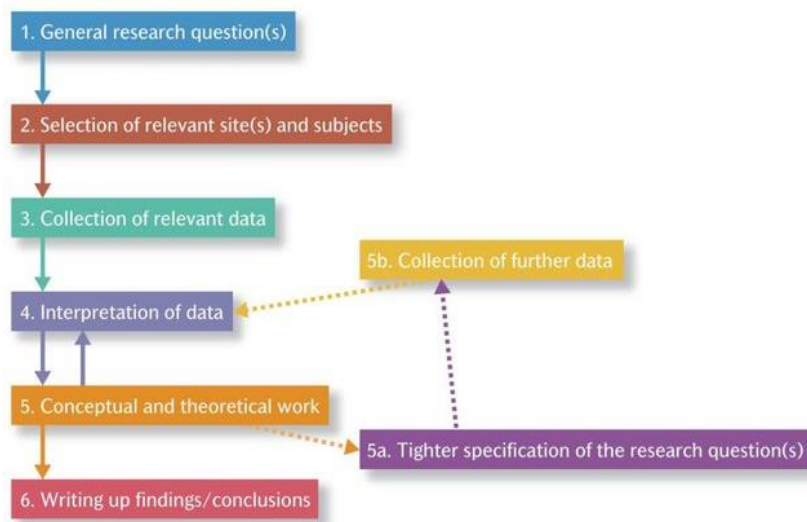


Figure 10: Main steps of qualitative research (Bryman, 2016, p.379)

Rural Fiji was chosen as the country of focus to narrow the scope to a manageable size. Additionally, the researcher had prior connections to stakeholders and experience working in the WASH sector in Fiji. Finally, Fiji has taken on a leadership role in advocating for PICs and SIDS in climate change adaptation and mitigation on the international stage (GoF, 2018a). However, Fiji also continues to struggle to increase access to safely managed WASH in rural communities (WHO, 2016).

3.1.2 Literature review

Data was first collected through a review of relevant literature. The literature search utilized online databases, search engines and reports and publication pages of civil society websites for gathering information. Both peer reviewed and grey literature was included in online searches in order to access a larger number of sources. In addition to online resources, books and module notes from previous WEDC modules were also used. The researcher also contacted WASH sector professionals who had conducted similar work in the Pacific area to share any relevant reports, such as Hadwen, et al. (2016). Table 4 shows the key words used in each step of the literature search. Online sources were also eliminated after scanning the abstract for context to judge their relevance

to the research. Relevant literature was also identified from the bibliographies of the articles and reports yielded from these sources. The analysis of the data collected during the literature review will be discussed in section 3.2.

Table 4: Key words used in literature search	
Search process	Key words
Step 1: Investigate the literature on climate change adaptation and disaster risk reduction in PICS	Climate change + disaster risk reduction + integration + PICS/Pacific/Islands
Step 2: Investigate the literature on the impacts and threats of climate change on water resources in SIDS and PICS	Climate change + water + PICS/Pacific + SIDS/Islands
Step 3: Investigate literature on WASH, climate change, and DRR in Fiji	Fiji + water/sanitation + climate change + Disaster/disaster risk reduction

3.1.3 Semi-structured Key Informant Interviews (KII)

The literature reviewed served to provide the necessary context and background to conduct the semi-structured interviews and therefore served to inform the semi-structured interview questions which were conducted with in Fiji. An emphasis on context is common in qualitative research (Bryman, 2016), and is given importance in this research as the impact climate change has on water and sanitation varies drastically depending on context. Therefore, it is necessary for the researcher to provide adequate context so the ways of managing climate change in the WASH sector can be understood. The narrowing of research questions from those used in the literature review to those used in the interview process is consistent with step 5a. and 5b. of Bryman’s main steps to qualitative research shown in Figure 10. Open-ended questions were used to avoid simple ‘yes’ or ‘no’ answers and attempt to gain deeper insight into the opinions of participants (Denscombe, 1998, p.194). Semi-structured interview questions were pre-tested with contacts the researcher already had in-country so that they can be improved upon prior to wider use.

Interviews were chosen as a tool for data collection for their appropriateness for helping provide data that could contribute to the research aim. Participant observation was excluded from the research methods as the research was focused on addressing the opinions of stakeholders, which could only be obtained by asking. Focus groups were not considered as an appropriate data collection tool as this research was interested in individual perspectives and wanted to avoid the participants being influenced by each other, which is a risk in focus groups (Bryman, 2016). Semi-

structured interviewed were selected, as they were the most appropriate to address the specific themes that were identified in the literature while allowing the participant flexibility in how they answer (Bryman, 2016). The researcher wanted to allow participants to share their own experiences and opinions. Thus structured interviews, with predetermined list of answers were considered too restrictive (Pratt and Loizos, 1992). Additionally, the researcher wanted to ensure that specific themes that had emerged from the literature were brought up to participants and discussed. Unstructured interviews would not have allowed for this (Bryman, 2016). Semi-structured interviews also allow the researcher a level of flexibility to ensure that themes outside those identified in the literature could emerge from the interview process (Bryman, 2016). Finally, similar research identified during the literature review utilized semi-structured interviews as a tool for collecting similar data (Chandra, 2010; Hadwen, et al, 2016). Table 5 lists the research questions this dissertation aimed to answer and the tools used to on each.

Table 5: Research objectives and questions and method of data collection	
Objectives and research questions	Data collection tool
<p>Objective 1: To assess Fiji’s rural WASH sector.</p> <ul style="list-style-type: none"> • Who are the main stakeholders in Fiji’s WASH sector? • What are the key policies and strategic plans governing the sector? • What are the major challenges to achieving SDG 6 in rural areas? 	Literature review and KII
<p>Objective 2: To determine key climate-related threats to WASH in rural Fiji.</p> <ul style="list-style-type: none"> • What are ‘key’ climate-related threats and how are these determined? • What is their impact on WASH? • How do these threats relate to non-climate related threats to sustainable WASH in rural Fiji? 	Literature review and KII
<p>Objective 3: To identify good practice approaches to climate-resilient WASH.</p>	Literature review and KII

<ul style="list-style-type: none"> • How are climate-induced hazards addressed in WASH software and hardware? • How do these approaches vary between stakeholders? 	
<p>Objective 4: Present recommendations based on comparisons made between interventions in Fiji and those identified in the literature reviewed.</p> <ul style="list-style-type: none"> • What are the gaps that the literature and research have identified? • Are there opportunities for increased knowledge sharing between government stakeholders and CSOs in Fiji? 	Literature review and KII

3.2. Scope

This research focused on civil society organizations (CSO) and government agencies that are involved in implementing WASH projects and programmes at a community level. While questions may include awareness of national or regional policy, the focus will be how this translates to work at the local level. Additionally, it is important to note that, for the purpose of this research ‘community level’ does not necessarily mean focusing on traditional communities, which in Fiji are known as Registered Fijian Villages. As the majority of reputable CSOs have their offices in Suva, this research will focus on interviewing participants who are based in the Suva area.

The following topics were considered outside the scope of the literature review:

- Climate change mitigation
- Analysis of policies

These were noted to be outside the scope of the research because they do not help to address the aim of the research. Genevaux (2018, p.55) describes climate change mitigation in relation to WASH as “seeking out low greenhouse gas emitting technical solutions”. Therefore, as this research focuses on rural areas of Fiji that commonly use low-cost on-site WASH systems that do not contribute to greenhouse gases, mitigation is not discussed. In regard to policy analysis, this research only draws on relevant literature on this topic to provide adequate context and background to analysis of guides local action.

3.3 Sampling and selection of KII

A sequential approach to sampling was used for this research. Bryman (2016, p.410) describes sequential sampling as “an evolving process” that allows the researcher to add participants as the research questions develop further. As with similar research identified in the literature, (Chandra, 2010; Hadwen, et al. 2016; Pearce, et. al., 2017), an initial list of key informants for interviews was compiled with the use of a stakeholder map and snowballing was then used to identify further participants. The initial list of participants was selected based on the following sampling criteria:

- **Both male and female participants:** *The researcher wanted to mitigate gender biased responses.*
- **Variety of cultural backgrounds (Indigenous Fijians, Indo-Fijian, and expatriates),** while aiming for the majority of participants to be Fijian citizens: *The reason for this is that the lack of local perspectives represented in the discourse on climate change is emphasized in the literature reviewed.*
- **Professionals in the WASH sector who worked at the community level:** *the aim of the research is to determine how the WASH sector integrates climate change resilience in projects implemented at a community level.*

As Bryman (2016) describes, sequential sampling allows initial sampling criteria to change as the research questions evolve. As data was collected from the initial list of participants, the selection criteria were widened to include two additional categories of participants:

- **Professionals who worked in water resource management sectors** (not WASH specifically): the researcher wished to gain insight into how other sectors who worked with communities on water resource management compared to their counterparts in the WASH sector.
- **National level stakeholders:** the researcher also wished to gain a greater understanding of the background and context of the WASH sector in Fiji, as well as, water resources management.

The number of participants was determined by theoretical sampling, rather than statistical sampling that is widely utilized in quantitative research (Bryman, 2016). In order to attempt to gain comprehensive information from these interviews, the number of participants was limited to ten.

3.4 Ethical Issues

The researcher will ensure to following ethical best practice for conducting interviews with the participants. Table 3 lists the ethical risks involved in data collection and the steps the researcher will take to mitigate these.

Table 6: Mitigating ethical risks

Ethical Risk	Mitigation
Participants do not give informed consent or no longer wish to participate	<ul style="list-style-type: none">• The researcher will clearly explain the purpose of the research, what is involved in the interview process and that participation is voluntary. Additionally, an initial email will be sent to potential participants with relevant information required to make an informed decision about participating in the research (Denscombe, 1998, p.344). This information sheet can be found in Appendix C.• Additionally, the researcher will utilize Loughborough University’s consent form template to ensure signed consent from each participant. The consent form can also be found in Appendix D.• The participant will be made fully aware that “it is their right to withdraw their consent at any time” (Denscombe, 1998, p.349).
Participants professional reputation is jeopardized by their responses	<ul style="list-style-type: none">• The name of participants will be kept confidential and only released to others if approval is given by the individual themselves (Denscombe, 1998, p. 349). This research gave random letters to each participant as means for referring to their data in the discussion section of this dissertation.
Research raises expectations of funding	<ul style="list-style-type: none">• The researcher will take care to give detailed explanations of themselves, the research, the purpose of the research and how it will be used (Pratt and Loizos, 1992, p.12).
Offending participants	<ul style="list-style-type: none">• The researcher will ensure careful wording of questions to ensure they are culturally sensitive, will not cause the participant to feel as though they are being criticised or cause them to feel defensive in any way.• The researcher will pre-test questions to get constructive and honest feedback before wider use (Denscombe, 1998, p. 192).
The time requirement is too demanding for participants	<ul style="list-style-type: none">• The researcher will pre-test interview questions to ensure completion time will not be more than thirty minutes. Additionally, the researcher will clearly state time requirement and stick to the allotted time during the actual interview (Denscombe, 1998, pp.188-189).

3.5 Data Analysis

Thematic analysis is the overall strategy utilized in the analysis of data. As such, this research did not have established themes from the start but rather allowed these to emerge throughout the process of data collection (Bryman, 2016). Therefore, data analysis was an iterative process which began as the literature was reviewed and continued throughout the interview process (Bryman, 2016; Denscombe, 1998). Thematic analysis was chosen so that all relevant data could be captured and compared to themes identified in the literature review. Bryman (2016, p.580) discusses that a key criticism of grounded theory is that the analysis of data can “result in a loss of context and narrative”. This was of concern for the researcher as an important aspect of the interviews is to gain a deep insight into the opinions of participants. The analysis of the literature served two purposes; to provide background and context for the researcher and a basis for further research (Bryman, 2016; Denscombe, 1998). Analysis of interviews will use coding and follow the steps, recommended by Bryman (2016) , that are outlined below:

- Immediately following completion of an interview, the researcher inputted the notes into Microsoft Excel. The researcher created a spreadsheet, organized by interview question and strived to retain the specific wording used by participants when copying responses.
 - The researcher made sure to highlight or make note of any particularly interesting responses.
- Following each new entry, the researcher re-read the previous interview notes, highlighting key words and made further comments on interesting points by beginning to compare responses.
- The researcher made sure to note all key words to maintain a broad view of the data and not exclude any data prematurely.
- The process of inputting data, reading through notes and identifying key words was repeated after each new interview entry.
- Once all interviews were complete, themes and sub-themes were identified as a result of repetition, similarities and differences in key words identified in interviewee responses, the literature reviewed, and gaps in the data.
- Themes and sub-themes were compared to one another for their relevance to the research aim and objectives, and how they relate to one another.
- Section 4 and 5 provide details on the above steps and a detailed discussion of why the final themes and sub-themes were selected.

3.6 Constraints, limitations, accuracy and reliability

Bryman (2016) discussed the reliability, accuracy, limitations and constraints of conclusions drawn from quantitative data. Pratt and Loizos (1992) draw attention to the potential for bias of research participants. In this research, it was important to acknowledge the potential bias in semi-structured interview responses, particularly when participants described the challenges and successes of their own projects and programmes (Pratt and Loizos, 1992). As Bryman (2016) recommends, the researcher will attempt to reduce bias by utilizing triangulation when comparing and contrasting interview responses with each other and with reference to the literature. As with the attempt to eliminate bias, the researcher strived to ensure a high quality of data by selecting literature from reputable sources and cross-checking references. Furthermore, interview participants who held senior positions with a significant number of years of professional work experience were identified. To address the researcher's own subjectivity, the importance of which Bryman (2016) points out, the researcher made a conscientious effort to be aware of this when conducting interviews and analyzing the data. Furthermore, to avoid any transfer of bias from the researcher to the interviewees, interview questions adhered to the good practice Bryman (2016, p. 471) describes, notably using open-ended questions and non-leading questions.

Another limitation of qualitative research that Bryman (2016, p.399) notes, is that “the people who are interviewed... are not meant to be representative of a population”. The researcher acknowledges that the responses from participants will not capture all the various opinions that may exist within the CSO and government and consequently will be careful not to generalize findings, as Denscombe (1998) warns against. Another common critic of qualitative research is there is too little transparency with how the researcher “arrived at the study's conclusions” (Bryman, 2016, p.399). Section 4 addresses following Bryman's (2016) recommendation to mitigate the risk of lack of transparency by providing a narrative on how the themes and sub-themes of the research were identified.

A constraint that is important to identify is that interviews were not recorded. Although Bryman (2016) emphasizes the importance of recording interviews, after two trials the researcher chose not to use this method. The reason for this is the emphasis in Fijian culture on informal talks as the key method of learning about the opinions that an individual holds. Pearce, et al. (2017, p. 504) describes a similar situation when collecting data in a Fijian community and describes these “*talanoa*” sessions as an effective way of gaining a deeper insight into the views of participants. Although this research targets professionals that work in an office environment, following the first two interviews, where participants were visibly uncomfortable when the recording device was used,

the researcher chose to no longer record interviews with the view of facilitating more open discussions.

A limitation of the data that the researcher would like to acknowledge is the absence of data from local government stakeholders. As the original scope of the data collection was focused on CSO employees, local government was not originally considered and only identified through snowballing late in the data collection period. Due to logistic and budget constraints the researcher was unable to collect data from this stakeholder group. This gap will be discussed in the conclusion, in the section for potential future research.

4. Data Analysis

The questions were developed from the key themes and gaps identified in the literature review. Section 2.7 discusses these themes and gaps in depth and how they informed the interview questions. Table 5 shows the results of reviewing the key words that came out of interview responses. Key words were identified based on repetition and similarity and differences in responses. Table 5 does not show all questions discussed in each interview. As the interviews were semi-structured, the specific questions asked varied with each interview. However, utilizing a framework approach (Bryman, 2016), Table 7 shows the main areas of discussion that evolved from the literature review and throughout the interview process. The key words were identified utilizing descriptive analysis so as to capture the context in which the data was given (Bryman, 2016).

Table 7: Key words identified by question theme	
Question theme	Key Words
Key climate threats to WASH in rural communities in Fiji	Cyclones, floods, drought, sea-level rise, landslide, storm surge, king tides, decreased surface water flows, vector borne diseases.
Impact of climate threat to WASH services	Damage to infrastructure, decrease water quality and quantity, exacerbate existing issues in WASH sector.
Key non-climate related challenges to sustainable WASH in rural communities in Fiji	Lack of community management capacity, poor maintenance, poor infrastructure, remote project sites, fragmented water sector, poor water resources management at national level.
Processes used for identifying, planning, implementing and monitoring projects	Community profiling, Climate Vulnerability Assessments, WASH Assessments,

	participatory approaches, target vulnerable groups, Community Development Committees, Water Committees, Community Development Plans, WSP, DWSP, Ridge-to-Reef, DWSSP, WAF, DWS, Provincial Administrators Office, Health Officers, Environmental Health Officers.
Funding	Challenges of project-based funding, role of banks, lack of funding.

As discussed in the methodology chapter, the key words identified in the data analysis processes were then compared with the themes identified from the literature reviewed. Sub-themes were identified based on key word repetition, similarities and differences, and significant gaps in the data collected. The following section will aim to provide a narrative on how the particular sub-themes and themes were identified by the researcher.

5. Results, Analysis, and Discussion

The aim of this section is to provide a detailed narrative of the results of the analysed data of semi-structured interviews, while linking to the literature reviewed to highlight similarities and gaps in the data and literature. Thematic analysis and descriptive coding were used to analyse the interview data and therefore the results below are organized into themes and sub-themes.

5.1 Theme 1: Separating climate-related risks to WASH from non-climate related risks

This theme helps to inform Objective 1 – *to assess Fiji’s rural WASH sector* of this research dissertation and the research questions 1.1 – *who are the main stakeholders in Fiji’s WASH sector?* 1.2 - *What are the key policies and strategic plans governing the sector?* and 1.3 - *what are the major challenges to achieving SDG 6 in rural areas?*

5.1.1 Results

5.1.1.1 Sub-theme 1.a): *A lack of community management capacity*

A lack of community management capacity was identified through repetition of similar key words as significant sub-theme in this section. Four key informants noted either working with community development committees or community water committees. Key informant I explained that larger communities will have separate water committees, however smaller ones may only have a development committee that is responsible for a number of aspects of community life. Key

informant B explained that these committees are mandated by the government and any WASH projects must work with these groups.

Poor maintenance was discussed by four key informants as a key outcome of the lack of communities' capacity to manage their WASH systems and a major challenge to sustainability in rural areas. Data from key informant J identified

"A major challenge we face is the commitment of communities to managing their [water supply] systems due to competing priorities in their daily lives".

- Participant C

training complexity coupled with time constraints as a contributing factor to building community capacity. Key informant A described that due to planning and logistics challenges trainings with communities are sometimes conducted before the WASH infrastructure is in place, which reduced the effectiveness of these trainings. The data varied on the participation of vulnerable groups in the management of WASH systems and services. Key informant C noted that women often took ownership of the hygiene component of WASH projects, as this falls within their traditional roles as family caretakers. However, key informant B said that while their project aimed to get women involved in the management of systems, the traditional structure of communities often impeded this. Key informant B described that men are traditionally in the leadership positions within a community and these perceptions of gender roles is an objective of their project. Key informant C described how management of WASH systems are not always prioritized by communities, as households often must dedicate their time to earning a living or farming so they can feed their family.

5.1.1.2 Sub-theme 1.2: Remoteness of rural communities

The data from two KII showed remoteness of rural communities as a key challenge to implementing and monitoring projects. Key informant B described the high cost of transporting materials to rural areas while key informant I's comments were in the context of monitoring. Key informant I discussed the lack of capacity of government agencies responsible for monitoring rural community WASH projects to travel to remote areas and thus quality of support and oversight suffered. Key informant I specifically noted the difficulty in monitoring communities on Fiji's small outer islands due to the cost of transportation.

5.1.1.3 Sub-theme 1.3: A fragmented Water Sector

The data shows multiple stakeholders involved in rural WASH and this theme was developed from comparing the similarities and differences in the KII data regarding how these stakeholders were discussed. Key informants A, C, and J described the important role of Provincial Administrators Offices (PAO) in providing oversight of the work of organizations in their

jurisdictions. Additionally, key informant C stated that it is important to work closely with the PAO to ensure continued support and monitoring for projects after they were completed, as they are the only government body that has the authority to enforce regulations in communities. However, key informant F raised the challenge to projects that focus on management of whole watersheds in having to work with different local governments as watershed boundaries often fall across multiple jurisdictions. Two KIIs showed that projects work with PAO to identify target communities but there is often gaps in WASH data from the PAO. Key informant A describes being advised to target one community but when the project team completed the initial assessment, it became apart the community had little needs in regard to WASH.

KIIs B and J also highlighted the importance of coordinating with District Health Officers and Environmental Officers for continued monitoring and support after project funding ends. Alternatively, key informant I discussed the responsibilities of Water Authority of Fiji and Department of Water and Sewerage staff to monitor community systems. Interestingly, key informants F and J were the only ones that commented on practical approaches to overcome fragmentation, which is to work with multiple levels of government to build capacity of the staff. Key informant G also discussed the challenges of fragmentation of the water sector at the national level and stated that a national water resources and sanitation policy was currently in draft to address this fragmentation. Key informant G described that this policy would provide guidance for sustainable management of water resources at the local level, utilizing principles of IWRM.

5.1.1.5 Land use

Land use is selected as a sub-theme as it highlights a gap in the interview data. Only participant D raised the issue of how poor land use practices are impacting water supplies. Participant D names agriculture, de-forestation and river dredging and major threats to Fiji's water resources. While the link between land use and water supply was only discussed by one participant it provides insight into how the opinions of stakeholders with different backgrounds vary and also links to theme 5.3.

“Fiji is a water rich nation but poor management of resources threatens this in the future”
- Participant D

5.1.2 Discussion

The interview data shows that rural communities are responsible for the management of their WASH services and often receive support from government agencies or CSOs. However, even those communities who receive external support in the form of funding for infrastructure, planning and design, and management training are still struggling to manage their systems. Some contributing factors that are illustrated in the data include, time constraints for delivering training and the complexity of training topics. While the literature reviewed also discusses the issues of

community managed systems (Chandra, 2010; Chaudhury, 2015; SPC, et al., 2003), the lack of government capacity to support rural management schemes is cited as the root of the issues (Chandra, 2010). Only String et al. (2017) specifically mentioned the complexity of training topics as a constraint to building management capacity. It is important to point out that there is a lack of peer reviewed external evaluations of WASH projects and the interview data is useful in providing specific examples from professionals who work in the field. The comments by key informant C, about those involved in community management not prioritizing their responsibilities, could be seen as an outcome of poor training. Livelihoods are inextricably linked to WASH, illness is related to contaminated water or poor sanitation and hygiene decreasing productivity and impacting livelihoods (WHO, 2016). This point also ties in with taking an all-risk approach to assessing communities, which is recommended by (Batchelor, et al., 2011). As the literature emphasizes, by focusing on holistic risk management, climate-related threats are more easily integrated into WASH planning (Genevaux, 2018; UNICEF Pacific, 2018).

When comparing the literature and interview data on community management, a key gap in the data is a discussion on cost recovery and financial management at the community level. UNICEF Pacific (2018) do draw attention to the influence of sound financial management on the ability of communities to maintain basic services and thus advance to a level of safely managed on the WASH ladders. From the point of view of the cost to CSOs and government, the remoteness of communities is described as impacting the cost of materials for any construction of infrastructure; . It is difficult to determine whether the lack of a discussion on cost recovery in the data is due to it not being a key challenge for communities, or the result of a lack of monitoring post project completion.

Government capacity ties into the sub-theme of a fragmented water sector, which Batchelor, et al. (2011) and SPC, et al. (2003) point out can lead to poor service delivery and coordination. As the data shows, CSOs rely on local government to continue monitoring and supporting communities after the funding for project activities comes to an end. The data shows that project timescales are often not adequate to ensure sustainability, suggesting the critical role government staff may have in aiding communities once CSOs exit. However, the data also shows that although projects rely on government workers for the long-term sustainability of their projects, there is not always project funding allocated to build capacity in the form of resources for these staff members. Although interviewees A, C, and B acknowledge the importance of coordinating with government, they did not discuss what occurs when the capacity of government staff is not there. If projects are relying on these stakeholders to carry out their work after funding for a project ends, but they are not dedicating any resources to building the capacity of the staff they will rely on, there is a big

question of long-term sustainability. The fragmented water sector does not easily enable coordination between CSOs and government. As the interview data and literature review show, there are numerous government agencies involved in rural WASH and building capacity in each would utilize significant resources. However, the interview data from key informant G shows that the Government acknowledges the issues of fragmentation and is addressing these with the development of a national water resources management and sanitation policy.

The remoteness of rural communities in Fiji is an issue that exacerbates low government capacity and resources. This is illustrated by the data and in the literature as a key challenge that both CSOs and governments face. The data supports Chaudhury (2015) and UNICEF Pacific (2018)'s statements that remoteness of the majority of rural communities in Fiji results in logistic, financial and monitoring challenges. Gero, et al. (2013) describes how governments are less active in remote areas, which is also supported by the data from participant I. The emphasis in the data on the challenge of remoteness of communities illustrates a key point made by Chmutina, et al. (2017, n.p) regarding the cause of vulnerability is "poor decision-making, practices... and planning". If there was appropriate planning and practices in place, the remoteness of communities should not be cited as a barrier to WASH coverage.

The discussion so far highlights two important sets of opinions contained in the data. When discussing existing WASH challenges, participants who were from CSOs often cited community management, government capacity and remoteness of rural communities. Participants from government cited remoteness and community management. Only participant J offered a critique of project practices; regarding how community training could be improved upon. Additionally, one government participant provided a critical view of their department, acknowledging the limited capacity and resources. However, the overall lack of data, both from interviews and in the literature, on lessons learnt from projects about the way a project planning, implementation and monitoring could impact sustainability, is an important gap identified by this research. The literature points to oversights by CSOs in appropriate technology selection (Batchelor, et al., 2011; Chandra, 2010; Paeniu et al., 2016; SPC, et al., 2003; UNICEF Pacific, 2018; WHO and SOPAC, 2008; WHO, 2016). However, the lack of data on this topic is an example of either an unwillingness or unawareness of the need for project implementers to critically evaluate their choices.

Another major challenge to sustainable rural WASH services that is discussed in the literature but only briefly identified in the data is poor land use Caritas (2018), WHO and SOPAC (2008), Batchelor, et al. (2011), Gero (2013), Scott, et al. (2003), and Chandra (2010). Participant D offers an interesting perspective on the issues of land use, as their projects encompass the

management of whole catchments and water resources is, thus, only one focus of the work. However, there is a gap in the data from participants whose projects fall exclusively into the WASH sector on the issues created by poor land use. This will be discussed in greater depth below in the section focused on IWRM.

5.2. Theme 2: A focus on extreme weather events

This theme addresses Objective 2 – *To determine key climate-related threats to WASH in rural Fiji* of this research dissertation and the research questions 2.1 *What are ‘key’ climate-related threats and how are these determined/measured?* 2.2 *What is their impact on WASH?* and 2.3 *How to these threats compare to non-climate related threats to sustainable WASH in rural Fiji?*

5.2.1 Results

5.2.1.1 Sub-theme 2.1: *Emphasis on tropical cyclones, floods and droughts*

The most common climate-related threats to WASH services identified by the participants were cyclones (7 KII), floods (6 KII), and droughts (4 KII). All participants who discussed these threats considered them key due to their impact on infrastructure. The following section aims to highlight specific details shared that are particularly relevant to this research dissertation. Participant C explained that the construction of water supply and sanitation facilities always adheres to the national building code, however, if a category 4 or 5 cyclone hits a community, there is little that can be done to avoid damage to infrastructure. Indeed, two participants noted that their projects targeting communities and schools that are still rebuilding after TC Winston, which hit Fiji over three years ago. It is important to note that all participants were involved in the relief efforts post TC Winston, and this event was referenced by all participants during the discussion of climate-related threats. In addition to damage to infrastructure, participant B described that droughts can lead to boreholes drying up, which reduces the quantity of water available to communities. Participant B offers a wider view on the impacts of drought on people’s livelihoods. Only two participants described the impact of flooding on the quality of drinking water. Participant H also links cyclones and floods to an increase in vector-borne diseases. The participants who discussed extreme weather events were WASH sector stakeholders from government, international organizations, and CSOs operating at the community level.

5.2.1.2 Sub-theme 2.2: *Little discussion on the gradual or slow-onset threats of climate change*

The data shows that only sea-level rise was mentioned as a gradual climate-related threat. Participant A and F discussed the impact of salt water intrusion into septic tanks and pit toilets that are built close to the coast. Furthermore, salinization of groundwater sources was also raised by

participant A as an impact on WASH. Participant F also discussed how frequent inundation during high tides, impedes access to WASH facilities. Unsurprisingly the participants who raised the threat of sea-level rise were those working directly with coastal communities. Although there are discussions on rainwater harvesting by two participants, the threat of increasingly variable precipitation was not noted. However, two participants did indirectly touched on rainfall variability. Participant D discussed the threat of decreasing surface water flows to communities and ecosystems and participant A described the damage to WASH infrastructure that landslides cause.

5.2.1.3 Sub-theme 2.3: Climate change exacerbates existing challenges

Although there is little data relating to this sub-theme from the interviews, the information that was gained is significant for its comparison with the literature. The data provided examples for how climate change is exacerbating existing challenges that communities face in accessing sustainable WASH services. Participant F offered a detailed description of one community, in which king tides now result in the whole community flooding and being polluted with excreta that has escaped from pit toilets. A further comment on infrastructure is given by Participant C who discusses that in certain projects communities provide material for constructing latrines. However, when this is the case, materials are often of low quality and are less likely to endure extreme weather. Participant D described how poor governance of water resource which allows for exploitation and pollution is exacerbated by droughts that further impact the water quantity and quality available to communities. Participant J describes that the majority of Fiji has achieved basic levels of services, utilizing the definitions provided by the SDG WASH ladders. However, for communities to move towards improved services, daily challenges created by poor management and government support must first be addressed. Participant J argues that climate change will magnify existing issues, such as poor technology choice and financial management and therefore it is critical to address these for communities to adapt to climate change.

“People wade through the water contaminated with raw sewage to reach the main road to catch buses to school and work.”
- Participant D

5.2.2 Discussion

The emphasis on climate-threats in the form of extreme weather events reflects the GoF’s (2017a) evidence of Fiji’s existing vulnerability to cyclones, floods and droughts. The focus on damage to infrastructure as a key impact of climate change logically follows the emphasis on the threat of extreme weather events. The GoF (2017a) notes that over seventy-five percent of Fiji’s population has been impacted by floods or cyclones over four decades, with sixty-two percent affected by TC Winston alone. Therefore, it is valid that there is such weight on these events in the data. The specific damage to infrastructure that participants describe also reflect those that are

described in the literature as being associated with cyclones, floods and droughts. Flooded septic tanks and pit toilets are represented in the data and support G nevaux (2018) observations regarding failure of sanitation systems due to hydraulic overloading. Additionally, as participant F and C notes, the risks of existing poor infrastructure are exacerbated by climate change in that they are more likely to break-down.

The impact that climate-related hazards can have on the accessibility is only raised in the context of sea level rise, however, G nevaux (2018, p.24) notes how this can also be caused by “extreme weather events... and intense rain events”. G nevaux (2018) and GoF (2017a) describe the risk of increased incidences of diarrheal and vector borne diseases that result from a break-down of WASH infrastructure and flooding but there was a limited amount of interview data on how climate-related hazards impact hygiene and health specifically. A contributing factor to this gap in the data can be linked to the challenges of monitoring rural areas that is described in section 5.1.2. This assumption is based on the acknowledgments by Participant I on the issue of reaching remote areas and corroborated by GoF (2017a) regarding gaps of information on rural areas.

The focus on damage to infrastructure caused by extreme weather events could be drawing attention away from the more gradual threats of climate change. When comparing the data to the literature, there is a gap in the data on the threat of increasingly variable rainfall (Bates, et al., 2008). This is considered an important gap to acknowledge given the common practice of rainwater harvesting in Fiji (WHO and SOPAC, 2008). Participant C describes that there is little that can be done to resist disaster of high magnitude, but this attitude overlooks what the data from key informant F and literature from WHO (2016) show on how climate change exacerbates existing issues of inappropriate or poor infrastructure. It is important that this fact be acknowledged, and attention not overly focused on responding to disasters at the expense of proactively building a community’s resilience to climate change. Participant J identifies how the existing challenges to moving towards improved WASH services that are the building blocks to resilience and states that a community that is struggling to move from basic service to improved service will not be able to manage the additional risks that climate-hazards pose. This observation supports the WASH resilience framework discussed by UNICEF Pacific (2018).

5.3 Theme 3: Moving up the WASH development ladders and integrating climate change resilience

This theme helps to achieve Objective 3 - *To identify good practice approaches to climate-resilient WASH* and answer research question 3.1 – *how are climate-induced hazards addressed in WASH software and hardware approaches?* This is a key theme that emerged from the analysis which focused on how climate change can exacerbate existing challenges to sustainable WASH

services. However, it is drawn out from the data, not through repetition, but rather by the different responses given by participants. The analysis of the data showed significant gaps when comparing participant responses.

5.3.1 Results

5.3.1.1 Sub-theme 3.1: Well established assessments exist in WASH sector

All interviewees described the importance of community assessments to informing their project work. However, the assessments used differed on the extent they focused on climate threats. Participant A, B, and C discussed that the aim of the assessments they used was to determine which households to prioritize for the provision of WASH infrastructure and identify water sources or supplies that could be developed or improved. They stated that climate threats were taken into consideration when assessing the location of WASH infrastructure. Participant E and J explained that the MoH utilizes WSP to assess all risks to the safety of current WASH systems. However, participant J explained that WSP need to be expanded to assess the security to WASH systems (DWSSP), which means moving towards IWRM as a wider range of risks to water supplies are considered. Interviewee F offers an alternative to DWSSP and discusses the use of Climate Vulnerability Assessments to holistically assess the risk of climate change to communities. Interviewee F described how these assessments integrate WASH, CCA and DRR and therefore can assist communities in prioritizing projects.

5.3.1.2 Sub-theme 3.2: Community participation

All interviewees noted community involvement in assessing, planning and implementing is facilitated through existing community committees. KII showed that although a variety of different assessments are used, there is a strong focus on bottom-up rather than top-down assessments. Participant C explained that depending on the size of the community, it may also have a water committee, in which case, WASH projects would work only with this committee. Participant B and C reference developing action plans as part of the capacity building training conducted with communities. However, participant J observed that NGOs need to have a greater focus on community engagement, especially regarding disaster response. Participant J described that during the response to TC Winston, the Australian Government targeted Koro, one of the most severely impacted islands. As a result, the local NGOs dedicated their efforts to other areas of Fiji. However, the response in Koro was technology heavy and involved little capacity building or community engagement. When project activities were completed, there were no processes in place for continued to support as NGOs had focused elsewhere. Participant J discussed how this situation

represents an excellent example of a missed opportunity by NGOs to build relationships and utilize sustainable approaches to develop community capacity.

5.3.1.3. Sub-theme 3.3: Defining climate-resilient WASH

A sub-theme theme that emerged from looking at similarities and differences in the data was the difficulty in defining what project activities were climate-resilient. For example, Participant B and C discussed that their work focused on rebuilding WASH systems that were damaged by TC Winston, however, they both stated that the design of systems was no different than before the cyclone but communities and schools were rather given additional rainwater storage tanks. Participant A described working with communities to improve emergency procedures in case of disasters, improving current water supply schemes to achieve a basic level of service, and training local women in plumbing so they have the skills to maintain and repair WASH schemes. Alternatively, participant H discussed the use of waste stabilization ponds that could absorb environmental shocks better than standard septic systems or pit toilets. Participant J discusses using the SDG WASH ladders to help define climate-resilient WASH activities. Participant J emphasizes that although activities that work towards achieving a basic level of service in communities do build climate-resilience, they focus on addressing the daily challenges to sustainable WASH access rather than the risks that are caused by climate change. Therefore, it is only when activities help communities move from basic to safely managed WASH that they can be considered climate resilient.

5.3.1.4 Sub-theme 3.4: Role of IWRM

Participants D, G and J discussed the importance of IWRM in planning and implementing climate-resilient water and sanitation projects. Participant G emphasized the central role of IWRM processes in improving water resource management, specifically noting the importance of using catchment areas as the basis for project planning. Participant G also describes the use of IWRM principles in recognizing the competing demands for water, acknowledging its limiting supply and minimizing its pollution. While participant G could not offer specific examples of projects utilizing this approach, the use of IWRM in a new national water resources management and sanitation policy is noted. participant D discussed the ridge-to-reef approach, which assists communities in developing plans for sustainably managing all natural resources, including water. Participant D also acknowledges the reality that Fiji cannot control other countries' emissions but improvement of national and local management of resources is an important step in adapting to climate change. Participant F also mentions project planning based on boundaries of a watershed to identify areas of high risk. Participant J briefly describes how IWRM is used in the DWSSP process when

communities move beyond basic service and focus on addressing the wider security risks to WASH caused by climate change and catchment activities.

5.3.1.5 Sub-theme 3.5: Resilient infrastructure and technology

This sub-theme was identified to capture the gap in interview data on resilient infrastructure and technology that emerged from comparing the differences in participant responses and when comparing these responses to the literature. Participant H described the use of waste stabilization ponds to manage all grey water and black water produced by target communities. Households were responsible for constructing flush toilets which they will be able to connect to these communal sanitation systems. Participant J and E point to the use of compost toilets in areas that experience water scarcity. Alternatively, participant I describes how technologies, such as ecological purification, solar powered desalination plants and advanced septic tanks that use filter mediums can enable rural communities to climb the WASH ladders.

5.3.1.6 Sub-theme 3.6: Financing resilience

Another important gap in the enabling environment that came out of the data analysis was that of funding mechanisms. Interviewee B and C described the limitation of project based funding has on sustainable WASH services. When discussing the use of multiple water sources as an approach to building resilience, interviewee C noted how funding was not sufficient to cover this. Furthermore, interviewee C admitted that funding tied to a project with set start and end dates was a challenge to sustainability as often more time was required to build community management capacity. Interviewee J raised the issue of funding in the specific context of building resilience to WASH, stating that it would take decades for communities to become more resilient and thus it is essential to establish funding that was not tied to projects. Furthermore, key informant J stated that there was insufficient donor funding available to achieve safely managed services in rural Fiji by 2030. Interviewee J was the only interviewee to offer solutions to this issue by discussing the role of the private sector, specifically banks. Interviewee J explained that if banks were involved, communities could seek loans to develop or improve their WASH services, which would also contribute to increased ownership and develop management capacity. Furthermore, interviewee J offered the scenario that when communities were able to achieve improved services, they would then be eligible for a grant to bring their WASH services up to the level of safely managed.

5.3.2 Discussion

Through comparing the data and recognizing similarity in responses, the use of assessments in the WASH sector was considered an important sub-theme to include. This sub-theme was also identified as it draws attention to the gaps in WASH assessments of climate change

threats. However, the interview data did show a gap in the extent to which some projects consider the risks caused by climate change. Participants A, B, and C note the importance of assessing climate-related risks when planning the location of infrastructure, which supports what G nevaux (2018) describes as key to decreasing exposure and thus vulnerability of a system. However, G nevaux (2018), along with WHO (2016), UNICEF Pacific (2018), and Hadwen, et al. (2016) stress utilizing an integrated approach, which is only supported by key informants H and J.

The interview data shows a similarity with the literature, in that those participants who described the use of holistic assessments are either focused on WASH and view climate change as one risk among many (participant J) or focused on climate change and WASH is one area of vulnerability among many (participant H). It is important to draw on what Chmutina, et al. (2017), Gero, et al. (2011), Seidler et al. (2018) point out; that at the community level, these distinctions are irrelevant. The importance to communities is that all risks are considered so that they can be adequately prioritized (G nevaux, 2018). The data shows the use of existing structures such as community development committees or water committees, along with community action or development plans to prioritize risks with communities. While community management is described in section 5.1.1.1 as a barrier to climbing that WASH ladders, the data does show good practices of engaging with communities. All participants described how community members were consulted regarding project activities. However, as the example offered by participant J shows, the focus on building community capacity is often overlooked in disaster situations. This links to the need to increase community participation in CCA and DRR activities (Batchelor, et al., 2011; Deere, et al., 2017; Dumar, et al., 2011; Kelman and West, 2009).

Therefore, the data indicates that although there is room for improvement in community engagement practices in the WASH sector, there are established bottom-up mechanisms in place that should be utilized in projects which have a CCA or DRR focus but also address WASH.

Distinguishing between what activities can be classified as climate-resilient is critical to further analysis



of the interview data. Participant J was the only participant to offer a clear explanation on how to define climate-resilient WASH activities. Utilizing the WASH ladders provides visual guidance that can be used to analyse the data from other participants. Figure 10 is provided for reference.

Participant J's comments link to the previous discussion on how climate change exacerbates existing risks to WASH services and the importance of addressing these prior to integrating issues associated with climate change. This outlook supports the views of G nevaux (2018) and UNICEF Pacific (2018) of first addressing the sources of non-climate relating challenges to build community capacity and once this has been achieved, move towards identifying and managing climate risks. However, when comparing the data presented by Participant J with data from the other participants, it illustrates a gap in clearly defining climate-resilient WASH activities.

The water supply deliverables described by participants were aimed at achieving a basic level of service. Only participant F and H provided examples of deliverables that aim to achieve a safely managed level of service. The use of waste stabilization ponds described by participant H, is a unique example in the data of resilience planning that is supported by G nevaux (2018) who calls for the use of nature-based solutions. G nevaux (2018, p.45) stresses the role of “nature-based solutions” to adapt to extreme weather and more variable rainfall patterns. The gap in data from the majority of participants on ecological treatment solutions reflects a similar gap in the literature, where sources that specifically focus on climate-resilient WASH, such as UNICEF Pacific (2018), Howard and Bartram (2010), and Luh, et al. (2017) do not address the role that these types of systems play in building resilience to climate-related threats.

Participant F notes that although a basic level of service is not currently in place in the target communities, the aim of the project is to support communities in moving up the WASH ladders from unimproved to basic to safely managed. This is further supported by the fact that participant F notes that the project takes a whole catchment approach to planning, which UNICEF Pacific (2018) considers an important factor in climate-resilient WASH. Hadwen, et al. (2016) and WHO (2016) also identify the use of IWRM processes for building resilience to climate-related hazards but do not offer guidance on practical application. The interview data on IWRM is from a government source who discusses the current gap in support for practical application. However, the key informant (G) describes that the new national water resources and sanitation policy will provide guidance to implementing IWRM at the local level. The absence of data on IWRM from professionals in the WASH sector is assumed to be linked to the scale on which projects are planned. This assumption is based on the focus of project planning based on community boundaries according to tradition resource management practices noted by key informant I. Alternatively, participants from projects that are not exclusively WASH focused discussed planning at a

catchment scale (KII F and D). This shows the potential for knowledge sharing across sectors to increase the use of IWRM principles in the WASH sector.

The sub-theme of project funding emerged from comparing data from key informant J with the data from the other key informants as it revealed a gap in their responses. Project funding was only described in the context of the challenge it presented to achieving deliverables. Conversely, key informant J acknowledged that donor funding cannot be relied upon to achieve the SDG targets by 2030 and the WASH sector should look to partnerships with private institutions. Participant J also emphasized how providing communities with access to loans to improve WASH infrastructure would increase ownership of their systems. Key informant J described that this system would create financial management capacity that would enable communities to sustainably manage grants focused on climate change adaptation. However, the lack of data from other key informants points to an emphasis on external funding used to bring communities from unimproved to safely managed. As described above, because these projects are considered climate change adaptation or resilience building, the literature shows that this creates a mentality that the challenges the community is experiencing are externally caused and the solutions should be externally funded. This reinforces the discussion on the importance of understanding the source of risks in order to understand how projects should be funded.

5. Conclusion

5.1 Reflection on research process and achievement

This section of the conclusion endeavours to show the extent to which research aim and objectives were achieved and research questions answered. The aim of this research was *to identify how stakeholders in Fiji's rural WASH sector are addressing the threats and impacts of climate-induced hazards to WASH in communities.*

This dissertation achieved the original aim of the research. Through a comprehensive review of the literature and key-informant interviews, sufficient data was gathered to inform the research aim. The research concludes that stakeholders in Fiji's rural WASH sector are faced with numerous existing challenges to reaching the SDG, many of which are or will be worsened by climate related-hazards. The literature review and KIIs show that not all stakeholders have sufficient knowledge of the influence climate change has on WASH nor how to account for this influence in planning. However, there are existing structures in place that support bottom-up approaches to assessing resilience and engaging with communities. While the mainstreaming of climate-resilient WASH has yet to occur, software and hardware approaches were identified through this research. DWSSP plans provide guidance for the software component of projects and are centred around building capacity within communities to manage their WASH services and build climate resilience. The

research concludes that hardware solutions should focus on nature-based approaches. Finally, IWRM was identified as the overall set of principles that can guide stakeholders towards climate-resilient WASH. However, increased knowledge sharing and coordination between sectors involved in water resource management, climate change and disaster risk reduction is needed to build capacity within the WASH sector to provide adequate support to communities.

5.1.1 Objective 1: To assess Fiji's rural WASH sector

5.1.1.1 Who are the main stakeholders in Fiji's WASH sector?

The literature review supported by KII provided information on the main stakeholders in Fiji's WASH sector and revealed multiple government ministries and departments responsible for different areas of WASH. There is no overarching coordinating government body for WASH in Fiji. While literature revealed that technical expertise in WASH is housed mainly in the Department of Water and Sewerage and the Ministry of Health, the Provincial Administrators Office was noted in the KII data as having a key role in providing long-term support to communities. The observations from the literature and the KII showed that this fragmentation results in inefficient use of resources and causes significant barriers for integrating climate change into planning.

5.1.1.2 What are the main policies and plans guiding the WASH sector?

The following key documents are noted in the research for the relevance of their goals to climate-resilient WASH.

- National Climate Change Policy, 2019
- Practical Guidelines For Rural Water Supply Management Plan, 2018
- National Adaptation Plan, 2018
- National Development Plan, 2017
- Rural Water and Sanitation Policy, 2016

The KII data illustrated that the current policies and plans do not provide detailed description of the roles and responsibilities of the stakeholders in the WASH sector in regards to implementing these policies at the community level. This is compounded by the number of stakeholders that have a role in WASH. However, the KII data also showed that a national water resources and sanitation policy is being drafted to address this issue.

5.1.1.3 What are the major challenges to achieving SDG 6 in rural areas?

Through an iterative processes that compared the literature with the KII data. The following broad categories of non-climate related challenges to WASH were created to capture the conclusions for the literature review and the KII data analysis. The first category is the capacity of communities to manage their WASH systems. While the role of community ownership and management in sustainability of rural WASH is well documented in the research, there is also an emphasis on the lack of capacity within communities to manage their WASH systems. This is

impacted by the remoteness of communities, limited funding available to access these areas frequently for training and monitoring activities, as well as, the complexity of training delivered to build capacity. The second category is the lack of government capacity to provide sufficient support to communities. This is also exacerbated by the remoteness of communities and the fragmented nature of the WASH sector as resources are divided amongst numerous departments. The final category is poor land management practices that are exacerbated by a lack of awareness within communities of how this may impact water resources and also by insufficient government oversight, which allows for exploitation and pollution resources.

5.1.2 Objective 2: To determine key climate-related threats to WASH in rural Fiji.

5.1.2.1 What are the key climate-related hazards and how are these determined?

Both the literature review and the KII focused on the increased frequency and/or intensity of extreme weather events that are resulting from climate change. The emphasis on tropical cyclones is a logical outcome of the data collection when taking into account the frequency in which Fiji experiences these events and the damage that they cause. Tropical cyclones not only threaten communities with strong winds but also cause storm surges that can inundate large areas of coastal land. While an increase in the variability of rainfall is predicted to occur in Fiji, it is extremely difficult for scientists to produce predictions that are useful for planning at the local scale. The final key climate-related threat that is most relevant to WASH in Fiji is a rise in average land temperatures.

5.1.2.2 What is their impact on WASH?

As a result of the focus on extreme weather events, the most cited impact on WASH is the damage of infrastructure. Strong winds, storm surge and flooding can destroy water and sanitation systems, flood sanitation facilities, and overload treatment systems. A decrease in rainfall and rise in temperatures will decrease surface water flows and groundwater recharge, which can also impact water quality as contaminants become more concentrated. Conversely, intense periods of rainfall can also decrease water quality as runoff increases the turbidity of water sources. If water systems are not designed to manage the fluctuation in water quality and quantity, this can lead to a breakdown in treatment systems. A decreased access to safely managed water and sanitation will impact health through a rise in diarrhoeal diseases and poor hygiene conditions. Finally, floods can also lead to an increase in vector borne diseases, further threatening the health of communities.

5.1.2.3 How do these hazards relate to non-climate related challenges to sustainable WASH in rural Fiji?

The conclusion from the literature and KII data is that climate-related threats exacerbate the existing challenges to achieving safely managed WASH services in rural areas. Climate-related hazards add further complexity to the management of rural WASH services. As concluded in

section 5.1.1.3, many communities do not have the capacity to cope with existing challenge, and thus do not have the foundation for building resilience to climate change. Likewise, with government capacity. Climate change will create more complex and inter-related challenges that will only magnify the existing issues of fragmentation in the WASH sector.

5.1.3 To identify good practice approaches to climate-resilient WASH.

5.1.3.1 How are climate-related hazards addressed in WASH software and hardware?

Software approaches that include climate-related hazards in WASH planning are centred around risk assessment and risk management. As such, CVA, WSP and DWSSP were identified as common ways to inform climate-resilient WASH initiatives. WSP is an existing tool recommended by the Department of Water and Sewerage and the KII data shows that updated WSP to DWSSP could be an efficient method of including climate change into the software components of WASH projects. The software approaches put community participation at the centre of building resilience through the use of existing committee structures. In regards to hardware approaches, there is a general call for the use of nature-based solutions and diversifying water supplies in the literature and KII. However, this research found limited evidence on these approaches and is thus suggested as a topic for further research. Within the data on hardware approaches there is a debate on infrastructure funding. Funding given to communities without training on financial management and cost recovery can result in a lack of ownership on the side of the community and threaten sustainable services. However, the research shows that while WASH projects acknowledge this threat, it is not the case with projects whose focus is CCA or resilience. Projects with a wider focus on adaptation and resilience must ensure that they dedicate the time and resources to establish sound management capacity in communities and that hardware is not viewed as a form of handout.

5.1.3.2 How do these approaches vary between stakeholders groups?

The different groups of stakeholder are divided between government and CSO but also between those in the WASH sector and those a part of the wider water resources management sector. While the literature review showed that WSP is promoted by the government, the KII data was extremely limited on their use. Stakeholders outside the WASH sector utilized their own form of VCA and focused on the catchment scale. The KII data also revealed similar hardware approaches across all projects, with the exception of one innovative project utilizing wet lands to treat grey and black water.

A key point that emerged from comparing stakeholder approaches is need to clearly distinguish WASH activities that help communities meet a basic level of service from those that move beyond to safely managed and thus resilience services. The research showed projects that are helping communities reach a level of basic services on the WASH ladders are often self-defined as

resilient focused. The danger of having ambiguous resilience targets is the misallocation of resilient funding that undermines the self-reliance of communities.

5.2 Review appropriateness of methodology

The use of semi-structured interviews was a useful techniques for collecting data on the opinions of key informants. Thematic analysis and descriptive coding was appropriate for analysis of the data and organizing it into main themes and sub-themes. The semi-structured interview processes allowed participants to share their opinions while being guided by broad topics identified in the literature. Additionally, due to the variety of data that emerged on certain topics, thematic analysis allowed this data to be organised and presented in a clear manor. Semi-structured interviews also allowed for sufficient detail and in-depth responses by key informants to be gathered, which helped provide invaluable context that could not be gained from the literature.

5.3 Recommendations

This section fulfils objective 4 of this research: *Present recommendations based on comparisons made between interventions in Fiji and those identified in the literature reviewed.*

5.3.1 Recommendations for Civil Society Organisations

The first recommendation drawn from this research is for CSOs working in the WASH sector to include project deliverables that focus on the building capacity of local government employees. While recognizing the limited funding that many projects have, evidence from this research suggests the crucial role that local government plays in ensuring the sustainability of projects. Therefore, appropriate resources should be dedicated to ensure that these staff members have the skills and knowledge to carry out these responsibilities.

The second recommendation is for CSOs to place a greater emphasis on the financial management and cost recovery aspect of community management capacity training. Climate-related hazards are likely to result in more frequent damage to WASH systems and communities should be assisted in establishing mechanisms that can help decrease dependence on external aid.

The third recommendation for CSOs is to adopt DWSSPs as a standardized software approach. Along with DWSSPs, the principles of IWRM should also be used to guide WASH interventions. Knowledge sharing across sectors should be encouraged so that the WASH sector can learn from CSOs already using IWRM and nature-based WASH solutions. Additionally, this knowledge sharing will help inform CSOs outside the water sector on the risks of external funding to dependence and community ownership.

5.3.2 Recommendations for government

The research recommends that the relevant government departments work with CSOs to develop a detailed framework for climate-resilient WASH. The aim of producing a framework would be to guide CSOs to take the appropriate steps to building resilience. In doing so, ensuring

that projects that claim to build resilience are more accountable to this fact. Furthermore, a standardized framework or guide would enable simpler monitoring and comparison between communities.

5.4 Further research

5.4.1 Role of private sector

A gap identified in this research is the role of the private sector in both providing financing options for community WASH systems and in supporting with operation and maintenance tasks. The potential role of the private sector in providing loans to communities was discussed by one key informant. However, it was not a concept that emerged from the literature review nor from other KII. Therefore, it would be interesting to conduct further research in different geographical areas to compare how the private sector can be involved in building climate-resilient WASH.

5.4.2 Local government capacity

A significant gap identified in this research is the specific role that local government has supporting community WASH. Although their role was mentioned during KII, examples of what this support looks like was difficult to find. The discussion of the role of local government was also largely absent from the literature review. Therefore, further research that focuses only on investigating the capacity gaps within local government would help contribute to a more complete picture of Fiji's WASH sector.

5.4.3 Nature-based solutions

The literature review and KII revealed limited examples of the use of nature-based solutions to increase the resilience of WASH in rural communities. Further research could be conducted to evaluate these examples and investigate the potential scalability of their approaches.

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7 Appendices

7.1 Appendix A: Definitions of key terms and concepts

Climate Change Adaptation	“the process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm” (G nevaux, 2018, p.31).
Climate-related hazard	“The potential occurrence of an event that may cause loss of life or injury, as well as damage and loss to business, services and the environment. This can be an extreme weather event or a longer-term trend” (G nevaux, 2018, p.18).
Exposure	“the presence of a human or natural element (people, species, ecosystems, environmental functions, economic activities, etc.) in places or settings that could be adversely affected” (G nevaux, 2018, p.18).
Impact	“The effect that a climate-related hazard has on a natural and human system. These effects manifest themselves locally on people’s lives, livelihoods, health, eco-systems, economies, societies, cultures, services and infrastructure” (G nevaux, 2018, p.18).
Resilience	“The ability of a system, community or society exposed to hazards to resist, absorb, accommodate, adapt, transform and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structure and functions through risk management” (UNIDSR, 2017).
Risk	“A common thread that can be drawn from all the definitions is that something (an event), may happen (probability/likelihood), that can lead to harm being caused (hazard), or not achieving something (impact/ consequences, that can be either good or bad). So although a diverse and sometimes complicated topic, risk is essentially looking at what and how likely it is that something will happen that is not desirable to a population” (UNICEF Pacific, 2018, p.16).
Vulnerability	“The conditions determined by physical, social, economic and environmental factors or processes which increase the susceptibility of an individual, a community, assets or systems to the impacts of hazards” (UNIDSR, 2017).

Appendix B

Table 8: Relevant policy documents to climate-resilient WASH in Fiji (UNICEF Pacific, 2018, 27).

Document type	Fiji Islands
National {R}WASH Policy	2012/2016
National {R}WASH Strategy	2012/2016
School WASH Standards	
RWASH Technical Standards	
National Climate Change Policy or Strategy	2012
UNFCCC National Communications	
NAPA	N/A
NAP or JNAP or JNIP	
National Water Resources Management Policy	2016
National Water Resources Legislation	2016
National Water Resources Management Plan	
National Water Supply Policy / Plan	2007/2016
National Water Supply Act	2007
Drinking Water Quality Standards	
National Sanitation Plan /Wastewater Policy	2016
National Integrated Water Policy or Strategy	2016
National IWRM Implementation Plan	
National Disaster Management Plan/Act	1995/1998
Drought Response Plan	2015
National Tsunami Plan	
Ministry of Health Strategic Plan or Strategy	2011-2015
National Sustainable Development Strategy	2009-2014
National Infrastructure Investment Plan	2015-2017
Constitution	2013
Outer Island Development Plans	
National Education Policy / Plan / Standards	2015
Legend	
Reviewed Document	2005
Issue covered by a Reviewed Document	2005
Unsecured Document	2005
No Relevant Document Identified	

Climate-resilient WASH in rural communities in Fiji

Adult Participation Information Sheet

My contact details:

Name	Role	Email address	Phone
Katie Drakeford	Masters Student	k.drakeford-16@student.lboro.ac.uk	+679 803 3894

Section A

I would like to invite you to take part in our study of climate-resilient WASH in rural and peri-urban communities in Fiji. Before you decide, I would like to explain the study and what your participation would involve. I will go through the information sheet with you and answer any questions you have. Please feel free to talk to others about the study before making a decision if you wish.

What is the purpose of the study?

The aim of the study is to investigate climate resilience within WASH interventions in Fiji. The objectives are to describe good practice approaches to climate-resilient WASH projects in rural and peri-urban communities in Fiji. Furthermore, I hope to describe the specific climate hazards that threaten WASH projects. I also want to learn about successes and challenges that organisations face in planning and implementing climate-resilient WASH projects. My goal of speaking to individuals who are working at the community level in Fiji is to gain a local perspective on the issues and approaches regarding climate-resilient WASH that are described in the literature.

Who is doing this research and why?

This study is being carried out by Katie Drakeford, MSc student from the Water, Engineering and Development Centre at Loughborough University, and is supervised by Dr. Ksenia Chmutina.

Are there any exclusion criteria?

Yes, there are some exclusion criteria.

You are a potential interviewee if you belong to an organisation that is responsible for implementing WASH projects in rural and peri-urban areas in Fiji.

What will I be asked to do?

After being introduced to the study you will be interviewed on the subject of climate-resilient WASH. Interview questions will be designed to facilitate a conversation that can provide local perspectives on the study topics.

Once I take part, can I change my mind?

Yes. After you have read this information and asked any questions you may have if you are happy to participate we will ask you to complete an Informed Consent Form, however if at any time, before, during or after the sessions you wish to withdraw from the study please just contact me. You can withdraw at any time, for any reason and you will not be asked to explain your reasons for withdrawing.

However, once the results of the study have been submitted (expected to be by: 1st June 2019) it may not be possible to withdraw your individual data from the research.

Will I be asked to attend any sessions and where will these be?

You will be asked to attend the interview, which will be scheduled according to your availability and held at a convenient time and location agreed with the researcher.

How long will it take?

The expected amount of time that your interview will take to complete is approximately 30 minutes.

Are there any disadvantages or risks in participating?

There is no expected disadvantage or risk in participating in the interview.

Data Protection Privacy Notice

Loughborough University will be using information/data from you in order to undertake this study and will act as the data controller for this study. This means that the University is responsible for looking after your information and using it properly. Loughborough University will keep identifiable information about you for ten years after the study has finished in compliance with the University's Data Protection policy. The University's Data Protection Officer can be contacted at: dp@lboro.ac.uk.

What personal information will be collected from me?

We are going to collect your name, contact details, and professional position.

Why is this personal information being collected?

Since numerous of stakeholders will be interviewed for each studied case, your personal information is collected for the researcher to identify and distinguish the numerous contributions within each specific case.

How long will my personal data be retained?

Loughborough University will keep identifiable information about you for ten years after the study has finished in compliance with the University's Data Protection policy.

Will my taking part in this study be kept confidential?

Yes. All personal information will be encoded or anonymised as far as is possible and consistent with the needs of the study.

You will be assigned a reference number or code and data will be stored against this number/code.

Coding details (e.g. Codebook) will be stored separately from the data.

Data will be stored and secured to prevent access from unauthorised third parties throughout the duration of the study and for as long as they will be retained.

How will the data collected from me be used?

The results of the study will be used for a Research Dissertation.

What is the legal basis for processing the data?

Personal data will be processed on the public task basis.

Individuals' rights to erasure and data portability do not apply if you are processing on the basis of public task. However, individuals do have a right to object.

Under the General Data Protection Regulation (GDPR), some of the personal data which will be collected from you is categorised as "sensitive data". The processing of this data is necessary for scientific research in accordance with safeguards. This means that study has gone through an ethical committee to ensure that the appropriate safeguards are put in place with respect to the use of your personal data.

Will my data be shared with others?

The data will be shared only between myself and my supervisor.

How long will the anonymised data/samples be retained?

The completed study will be permanently archived to the Loughborough Data Repository and freely available online.

Loughborough University will keep identifiable information about you for ten years after the study has finished, in compliance with the University's Data Protection policy.

The University's Data Protection Officer can be contacted at: dp@lboro.ac.uk.

I have some more questions; who should I contact?

For any further information you can contact me on k.drakeford-16@student.lboro.ac.uk

If you have any questions more generally regarding Data Protection at the University, then please do contact the Data Protection Officer on dp@lboro.ac.uk or write to The Data Protection Officer at Academic Registry, Loughborough University, Loughborough, Leics, UK LE11 3TU.

What if I am not happy with how the research was conducted?

If you are not happy with how the research was conducted, please contact the Secretary of the Ethics Approvals (Human Participants) Sub-Committee, Research Office, Hazlerigg Building, Loughborough University, Epinal Way, Loughborough, LE11 3TU. Tel: 01509 222423. Email: researchpolicy@lboro.ac.uk

The University also has policies relating to Research Misconduct and Whistle Blowing which are available online at <http://www.lboro.ac.uk/committees/ethics-approvals-human-participants/additionalinformation/codesofpractice/>.

If you have taken steps to have a concern or complaint about Loughborough University's handling of data resolved but are still not satisfied you have a right to lodge a complaint with the Information Commissioner's Office (ico), who are the relevant regulator for data privacy and protection matters. The ico can be contacted at Wycliffe House, Water Lane, Wilmslow, SK9 5AF and you will find more information at <https://ico.org.uk>.

Section B

Is there anything I need to bring with me?

Any training resources, good practice documents or other documents relevant to the areas and topics we are going to discuss, are welcome.

Climate-resilient WASH Services in Rural Communities in Fiji

INFORMED CONSENT FORM

(to be completed after Participant Information Sheet has been read)

Taking Part

**Please initial
to confirm
agreement**

The purpose and details of this study have been explained to me. I understand that this study is designed to further scientific knowledge and that all procedures have been approved by the Loughborough University Ethics Approvals (Human Participants) Sub-Committee.

I have read and understood the information sheet and this consent form.

I have had an opportunity to ask questions about my participation.

I understand that taking part in the project will involve being interviewed and recorded (audio or video).

I understand that the personal information collected will be my name, profession/job title

I understand that I am under no obligation to take part in the study, have the right to withdraw from this study at any stage for any reason, and will not be required to explain my reasons for withdrawing.

Use of Information

I understand that all the personal information I provide will be processed in accordance with data protection legislation on the public task and will be treated in strict confidence.

I understand that information I provide will be used for the purpose of a Master's Dissertation.

I understand that personal information collected about me that can identify me, such as my name or my place of employment, will not be shared beyond the study team.

I agree that information I provide can be quoted anonymously in research outputs.

I give permission for the anonymised data I provide to be deposited in the Loughborough University Data Repository so that it can be made publicly available for future research at the end of the project.

Consent to Participate

I voluntarily agree to take part in this study.

Name of participant [printed] Signature _____ Date

Researcher [printed] Signature _____ Date

Appendix E: Semi-Structured Interview Questions

The questions listed below were those the researcher used to guide the semi-structured interview process but varied depending on the natural flow of the interviews and the role and background of the key-informants.

Prior to starting the interview process, the research reviewed the Participant Information Sheet and Consent Form with Participants. Participants were then asked to sign the consent form. Upon completing the interview, the researcher reiterated that participation in the research was voluntary and if the participant decided they did not what their responses included they were advised to inform the researcher prior to June 1st, 2019.

Questions:

1. What are the objectives of the WASH programme/projects the organization is currently involved in?
 - i. What are the project's target geographical areas?
2. What type of water supply systems, sanitation facilities and hygiene awareness currently exist in the project area?
3. What are the main barriers to sustainable WASH services in rural areas?
 - i. What is currently the priority to address?
4. Does the organization have Disaster Risk Reduction and/or Climate Change Adaptation programmes or projects?
 - i. How are activities coordination between these different projects?
5. What are the most serious climate hazards that impact communities?
 - i. How are these identified?
 - ii. How are these impacting WASH services?
 - iii. How is the community managing these hazards?
 - iv. How is the project addressing these hazards?
6. Are there particular challenges and successes you would like to highlight from your experience in Fiji's WASH sector?
7. Do you have anything else you would like to add or any questions for me?

Appendix F: Signed Consent Forms

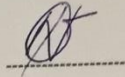
Climate-resilient WASH Services in Rural and Peri-Urban Communities in Fiji

INFORMED CONSENT FORM
(to be completed after Participant Information Sheet has been read)

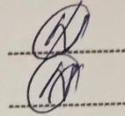
Taking Part

Please initial
to confirm
agreement

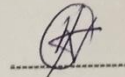
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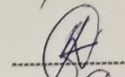
I have read and understood the information sheet and this consent form.



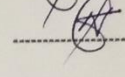
I have had an opportunity to ask questions about my participation.



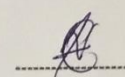
I understand that taking part in the project will involve being interviewed and recorded (audio or video).



I understand that taking part in the study implies involuntary recollection of stressful events as potential risk.



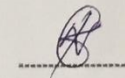
I understand that the personal information collected will be my name, profession/job title



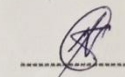
I understand that I am under no obligation to take part in the study, have the right to withdraw from this study at any stage for any reason, and will not be required to explain my reasons for withdrawing.

Use of Information

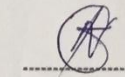
I understand that all the personal information I provide will be processed in accordance with data protection legislation on the public task and will be treated in strict confidence.



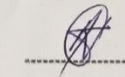
I understand that information I provide will be used for the purpose of a Master's Dissertation.



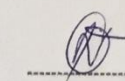
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I agree that information I provide can be quoted anonymously in research outputs.



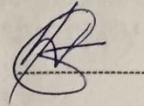
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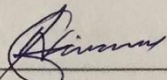


MSc Research Dissertation – Katie Drakeford (B532646)

Consent to Participate

I voluntarily agree to take part in this study.



TOMASI - NIUCANU [printed]  Signature 28/5/19 Date

Katie Drakeford [printed]  Signature 25/3/19 Date

Climate-resilient WASH Services in Rural and Peri-Urban Communities in Fiji**INFORMED CONSENT FORM**
(to be completed after Participant Information Sheet has been read)Please initial
to confirm
agreement**Taking Part**

The purpose and details of this study have been explained to me. I understand that this study is designed to further scientific knowledge and that all procedures have been approved by the Loughborough University Ethics Approvals (Human Participants) Sub-Committee.

Katabua

I have read and understood the information sheet and this consent form.

KT

I have had an opportunity to ask questions about my participation.

KT

I understand that taking part in the project will involve being interviewed and recorded (audio or video).

KT

I understand that taking part in the study implies involuntary recollection of stressful events as potential risk.

KT

I understand that the personal information collected will be my name, profession/job title

KT

I understand that I am under no obligation to take part in the study, have the right to withdraw from this study at any stage for any reason, and will not be required to explain my reasons for withdrawing.

*KT***Use of Information**

I understand that all the personal information I provide will be processed in accordance with data protection legislation on the public task and will be treated in strict confidence.

KT

I understand that information I provide will be used for the purpose of a Master's Dissertation.

KT

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KT

I agree that information I provide can be quoted anonymously in research outputs.

KT

I give permission for the anonymised data I provide to be deposited in the Loughborough University Data Repository so that it can be made publicly available for future research at the end of the project.

KT

Consent to Participate

I voluntarily agree to take part in this study.

NTA

Kesania Tabinnakawai
Name of participant [printed]

Kesania Tabinnakawai 26/2/2019
Signature Date

Katie Drakeford
Researcher [printed]

[Signature] 26/2/19
Signature Date



Climate-resilient WASH Services in Rural and Peri-Urban Communities in Fiji

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agreement

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[Handwritten initials]

I have read and understood the information sheet and this consent form.

[Handwritten initials]

I have had an opportunity to ask questions about my participation.

[Handwritten initials]

I understand that taking part in the project will involve being interviewed and recorded (audio or video).

[Handwritten initials]

~~I understand that taking part in the study implies involuntary recollection of stressful events as potential risk.~~

[Handwritten initials]

I understand that the personal information collected will be my name, profession/job title

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[Handwritten initials]

Use of Information

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[Handwritten initials]

Consent to Participate

I voluntarily agree to take part in this study.

Sup. Harrison
Name of participant [printed]

[Signature] 05/3/19
Signature Date

Katie Drakeford
Researcher [printed]

[Signature] 05/3/19
Signature Date

Climate-resilient WASH Services in Rural and Peri-Urban Communities in Fiji

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Alex. W

I have read and understood the information sheet and this consent form.

Alex W

I have had an opportunity to ask questions about my participation.

Alex. W

I understand that taking part in the project will involve being interviewed and recorded (audio or video).

Alex W

~~I understand that taking part in the study implies involuntary recollection of stressful events as potential risk.~~

Alex W

I understand that the personal information collected will be my name, profession/job title

Alex W

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Alex W

Use of Information

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Alex W

I understand that information I provide will be used for the purpose of a Master's Dissertation.

Alex W

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Alex W

I agree that information I provide can be quoted anonymously in research outputs.

Alex W

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Alex W

Consent to Participate

I voluntarily agree to take part in this study.

Alex. W.

<u>Alex Wilson</u> Name of participant [printed]	<u>Alex. W.</u> Signature	<u>6/3/2019.</u> Date
<u>Katie Drakeford</u> Researcher [printed]	<u>[Signature]</u> Signature	<u>6/3/19</u> Date



Climate-resilient WASH Services in Rural and Peri-Urban Communities in Fiji

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[Handwritten initial]

Consent to Participate

I voluntarily agree to take part in this study. -----

MARC OVERMARS
Name of participant [printed]

[Signature]
Signature

29/3/19
Date

Katie Drakeford
Researcher [printed]

[Signature]
Signature

29/3/19
Date



Climate-resilient WASH Services in Rural and Peri-Urban Communities in Fiji

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Kavan

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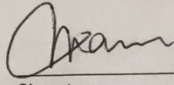
Kavan

Consent to Participate

I voluntarily agree to take part in this study. -----

John Housio

Name of participant [printed]



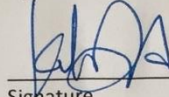
Signature

13/03/19

Date

Katie Drakeford

Researcher [printed]



Signature

13/03/19

Date



Climate-resilient WASH Services in Rural and Peri-Urban Communities in Fiji

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AS

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Amit Singh
Name of participant [printed]

[Signature]
Signature

07/03/2019
Date

[Signature]
Researcher [printed]

[Signature]
Signature

07/03/2019
Date

Katie Drakeford



Climate-resilient WASH Services in Rural and Peri-Urban Communities in Fiji

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NE

Consent to Participate

I voluntarily agree to take part in this study. -----

NISTAR KHAN
Name of participant [printed]

[Signature]
Signature

18/03/19
Date

Katie Drakeford
Researcher [printed]

[Signature]
Signature

18/03/19
Date



Climate-resilient WASH Services in Rural and Peri-Urban Communities in Fiji

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Consent to Participate

I voluntarily agree to take part in this study.

Sinia Gallo
Name of participant [printed]

[Signature]
Signature

12/03/2019
Date

Katie Drakeford
Researcher [printed]

[Signature]
Signature

12/03/2019
Date

Climate-resilient WASH Services in Rural and Peri-Urban Communities in Fiji

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agreement

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K Drakeford

I have read and understood the information sheet and this consent form.

K Drakeford

I have had an opportunity to ask questions about my participation.

K Drakeford

I understand that taking part in the project will involve being interviewed and recorded (audio or video).

K Drakeford

I understand that taking part in the study implies involuntary recollection of stressful events as potential risk.

K Drakeford

I understand that the personal information collected will be my name, profession/job title

K Drakeford

I understand that I am under no obligation to take part in the study, have the right to withdraw from this study at any stage for any reason, and will not be required to explain my reasons for withdrawing.

K DrakefordUse of Information

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K Drakeford

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K Drakeford

Consent to Participate

I voluntarily agree to take part in this study. -----

Elena Randerath
Name of participant [printed]

E Randerath
Signature

12/02/19
Date

Katie Drakeford
Researcher [printed]

K Drakeford
Signature

12/02/19
Date