Does women's participation in water committees affect management and water system performance in rural Vanuatu?

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Greater participation of women in water management and decision-making is expected to improve outcomes for both women and the wider community. Global evidence indicates that women's participation in Water User Committees (WUCs) has been limited; yet their involvement in management has correlated with more effective water systems. This analysis of water inventory data from Vanuatu considers how women's participation in WUCs affects water management and system functionality. Women represent only 16 per cent of committee membership; however, their involvement in key WUC roles was associated with more effective water management, including regular meetings and revenue collection, and improved functioning of water systems. This evidence of women's involvement is proving useful in advocacy efforts to improve the gender balance in WUCs, and targets for female membership are being considered for inclusion in water supply legislation.

Keywords: gender, rural water services, management, functionality, Vanuatu

THERE IS AN INTERDEPENDENCY between Sustainable Development Goal (SDG) 5, 'achieve gender equality and empower all women and girls', and SDG 6, 'ensure availability and sustainable management of water and sanitation for all'. Women are often the main users of water in the household in their gendered, domestic tasks of cooking and cleaning (Upadhyay, 2004; Watts, 2004; United Nations Department of Economic and Social Affairs, 2005; Ray, 2007; Acey, 2010; Aladuwaka and Momsen, 2010; Brocklehurst and Bartram, 2010; Remigios, 2011; Fagan et al., 2015). They also generally bear the burden of labour in fetching water and caring for family members who become sick as a consequence of inadequate water supply (Fisher, 2006, 2008; WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation, 2010; Kilsby, 2012; Carrard et al., 2013). As a result, well-targeted investments in water systems are reported to provide greater benefits for women (Devasia, 1998; Enabor, 1998; Ray, 2007; Fisher, 2008; Aladuwaka and Momsen, 2010; Arku, 2010; Brocklehurst and Bartram, 2010;

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Remigios, 2011; Kilsby, 2012; Fagan et al., 2015). Benefits have been reported to include improved health and quality of life as well as greater productive potential, resulting from the reduced time burden in water collection (Fisher, 2006; Willetts et al., 2009; Aladuwaka and Momsen, 2010; Brocklehurst and Bartram, 2010; Kilsby, 2012; Schweitzer, 2013).

Water supply services are managed either by the government, private sector, local community, or a combination of these. In rural areas in Africa, Asia, and the Pacific, the community-based management (CBM) model has been widely adopted for water management. The infrastructure for water supply is generally constructed by government, civil society, and non-governmental organizations and then handed over to the community, to be managed by a water user committee (WUC). To ensure service provision, the WUC is expected to collect user fees and oversee the operation and maintenance of the system.

The Vanuatu National Water Strategy supports a CBM model for water supply (Department of Geology, Mines & Water Resources, 2008). The majority of rural households have access to an improved water source (88 per cent): 30 per cent is piped into the dwelling, 44 per cent is rainwater, and the remaining 14 per cent is 'other improved' (National Statistics Office, 2013). Water collection has traditionally been a task for women and children, particularly when sources are far from villages (Department of Geology, Mines & Water Resources, 2008). This is supported by data from the 2007 Multiple Indicator Cluster Survey which found that women do 65 per cent of water fetching (Vanuatu Ministry of Health, 2007). The National Water Strategy promotes the involvement of women in local water committees, including in planning for and managing the resource, but there is no mandated target for female participation (Department of Geology, Mines & Water Resources, 2008).

As a result of social norms, decision-makers in water policy and management worldwide have usually been men, with women having limited influence (Michael, 1998; United Nations Department of Economic and Social Affairs, 2005; Ray, 2007; Fisher, 2008; Acey, 2010; Kilsby, 2012; Carrard et al., 2013; Peacock, 2015). Female membership of WUCs can provide a proxy measure for women's involvement in water management. However, WUC membership does not guarantee women's active involvement in decision-making (Kilsby, 2012; World Health Organization, 2012). Even when national policies and affirmative action support women's participation in water management, there are often obstacles to their meaningful rather than tokenistic representation (Kilsby, 2012; World Health Organization, 2012). Assessing whether women hold key posts in the committee may provide a better indication on their level of participation in decision-making.

It is generally assumed that, since women are the main beneficiaries of water service delivery, they have a vested interest in its success, and their involvement in management decision-making will lead to better performance. By improving the participation of women in water management, including in key posts, it is believed that water programmes and policies will be more efficient and effective (United Nations Department of Economic and Social Affairs, 2005; Fisher, 2006,

2008; Carrard et al., 2013). While there has been no systematic review on the subject, studies from Africa, Asia, and Latin America appear to support this hypothesis (van Wijk-Sijbesma, 2001; Foster, 2013; Whalen and Belo, 2013). It is also reported that women's involvement in water management enables them to develop confidence, self-reliance, and leadership skills and to gain more power and respect in the community (United Nations Department of Economic and Social Affairs, 2005; Fisher, 2006; Aladuwaka and Momsen, 2010; Kilsby, 2012; Carrard et al., 2013). Changes in attitudes regarding traditional gender roles, more respectful relationships between men and women, and reductions in family conflict and violence against women have also been reported (Willetts et al., 2009; Kilsby, 2012; Carrard et al., 2013). The following analysis sought to better understand women's roles in water management, the level of women's participation, and any impact on WUC and water system functioning.

Methodology

Data

The Department of Geology, Mines & Water Resources (DGMWR) of Vanuatu, with support from UNICEF, conducted a national census of water points from 2014 to 2016. The census covered all six provinces with data collection by trained enumerators. Pilot data collection first took place in Shefa province in 2014 and, based on the pilot findings, modifications were made in the questionnaire. Further data collection was done by DGMWR staff in Torba and Sanma province, NGO staff in Tafea and Malampa and by students in Penama province. All enumerators were trained by the DGMWR and UNICEF with theoretical instruction on the tools and the definitions, followed by a practical data collection exercise in Shefa province. The training was concluded with a review of the data collected during the field exercise, which provided a feedback loop. A verification of all collected data took place by displaying the data on a geographical map with habitations. This revealed that some habitations were missed in this census and additional data collection, to cover these, is planned in the future.

The national census found 8,000 water points in six provinces. The pilot Shefa province, with 4,911 water points, was excluded from further analysis because of the lack of gender information. The remaining records for 3,089 water points, covering the other five provinces, were screened to determine whether they were community-owned. A total of 1,175 community-owned water systems were identified for which the authors obtained DGMWR clearance for data analysis.

The national census of water points collected information on type and characteristics of the water system, ownership, funding of installation, status of the system, use, and management, as well as observations on the presence of potential pollutants. Of the 1,175 community-owned water systems, the majority, 810 (69 per cent), had no committee in place, while the remaining 365 (31 per cent) did. For water systems with a committee, further questions were asked on the committee composition and the positions occupied by women. Data from the 365 community-owned

water systems with committees was analysed to determine whether women's participation in water management affected management functions and system functionality.

Analysis

Data was processed using Microsoft Excel and analysed using STATA 13. The full dataset of 1,175 community-owned water systems was used to assess whether a WUC makes a difference in the functionality of the water system. For assessment of participation of women, the smaller data set of 365 systems with a WUC in place was used.

Bivariate analyses were conducted to explore the questions: 1) Does a WUC make a difference to water system functionality; 2) To what extend do women participate in a WUCs; and 3) Does women's participation in WUCs make a difference in management and system functionality? Functionality of systems is categorized as described in Table 1.

Pearson chi-square tests of independence were performed to assess significance of the relations between WUCs with women in key roles and collection of water fees and regularity of committee meetings. Sample responses for the collection of user fees were split into three variables and regularity of committee meetings divided into four for further analysis. Each response was converted to a binary variable: '1' was assigned when the response was selected, otherwise a '0' was assigned. For regularity of committee meetings, one additional variable was created to describe regular meetings by combining responses for 'four times per year' and 'less than four times but more than once'. A binary variable was also constructed for functionality of the water system. For this variable, not working or poor condition was assigned '0' for not functioning, while good or fair condition was assigned '1' for functioning. A two-sample t-test or Pearson chi-square test was utilized for further analysis of the relationship between women's participation and functionality of the system or regularity of committee meetings.

Multivariate regression analysis was used to assess whether the significant contribution of women's participation held across different system characteristics, including type, age, and size, with the latter measured by the number of people served. Potential confounding was controlled by assessing the strength of association of known variables that could affect functionality (i.e. system type,

Table 1 Functionality definitions

Description	*Definition*
Good	In good working condition, minor repairs required that can be managed locally
Fair	Minor problems and repairs needed, may require external assistance
Poor	Barely functioning, major repairs needed, will require external assistance
Not working	Not working

age, and size). Different system types have different levels of complexity and varying susceptibility to failure. Large systems have more parts resulting in an increased cumulative risk of failure. As water systems have a limited lifespan, the older a system, the more likely it is to fail. Other control variables that could confound, such as the availability of external support mechanisms, distance to a provincial capital, and seasonal timing, were not included as this information was not available. Functionality of the system is used as a dependent variable. The purpose of this analysis is not to establish causality but to understand whether women's participation is a significant predictor of functionality of water system compared with other determinants. To this end, association is sufficient. A logit regression model was run to estimate the relationship between the dependent variable and women's participation, while controlling for other covariates with the use of the Bernoulli distribution. The summary statistics of the key variables used in the model are presented in Table 2. About 71 per cent of systems with a WUC were classified as functioning. The census collected information on date of installation of the system that was used in the analysis to reflect the age of the system.

Table 2 Summary statistics of dependent and independent variables

Variable	*Observations*	*Mean*	*Std dev.*
Dependent variable			
System functionality (1 = good/fair)	365	0.712	0.453
Independent variables			
Women occupying key positions (1 = Yes)	365	0.510	0.501
Year built			
2010–2015	365	0.392	0.489
2000–2009	365	0.219	0.414
1990–1999	365	0.132	0.338
1980–1989	365	0.178	0.383
<1980	365	0.079	0.271
Type of system			
Piped system	365	0.600	0.491
Rainwater	365	0.266	0.442
Spring/well/borehole	365	0.134	0.341
Number of people dependent on the system			
<51	365	0.241	0.428
51–100	365	0.238	0.427
101–150	365	0.137	0.344
151–200	365	0.107	0.309
201–250	365	0.077	0.266
>250	365	0.200	0.401

Results

Does a WUC make a difference?

The census survey provided an opportunity for the functionality of community water systems to be rated. Of 1,175 systems, 29 per cent were rated in good condition, 35 per cent in fair condition, and 36 per cent in poor condition or not working. The analysis compared systems without a WUC to those with a WUC. As illustrated in Table 3, systems with a WUC are more likely to perform better than those without a WUC. Systems in 'good condition' were reported for 24 per cent of water points without a WUC, compared to 39 per cent of systems with a WUC (X^2 (3, N = 365) = 37.6, p<0.01). Further analysis to confirm the direction of influence shows that systems without a WUC were more likely to be associated with a water system rating of 'poor or not working' than those with a WUC (39 per cent compared with 29 per cent for systems with a WUC, t (1173) = 3.44, p<0.01).

To what extent do women participate in a WUC?

For the 365 community water points with a WUC, there was an average of six members per committee and a total of 2,237 members across the six provinces. Of these WUC members, 16 per cent (365) were female (see Figure 1). Just over half of the WUCs (186, 51 per cent) reported having at least one key post held by a woman (see Figure 2). Of these, approximately half the posts were as secretary (53 per cent), 40 per cent as treasurer, and 7 per cent as chair (see Figure 3).

Does women's participation in WUCs make a difference to system management and functionality?

For all 365 WUCs, over half (56 per cent) reported not meeting regularly, 28 per cent met one to three times per year, and only 16 per cent met every quarter. No difference in quarterly meetings was noted between committees with and without female members. However, WUCs with women in key posts met more regularly, where regular meetings were defined as meeting more than once per year, than compared to those with only men in these roles (41 per cent compared to 31 per cent, X^2 (1, N = 365) = 4.50, p<0.05) (see Figure 4).

Table 3 Presence of community engagement structure and functionality of system

Functionality of system	*Community engagement structure*		*Significance tests*
	Committee in place	*No committee in place*	
Good	38.9	24.0	
Fair	32.3	37.0	
Poor	26.6	30.6	Chi2 (3) = 37.6***
Not Working	2.2	8.4	
Total (n)	365	810	

*** Significant at 1% level

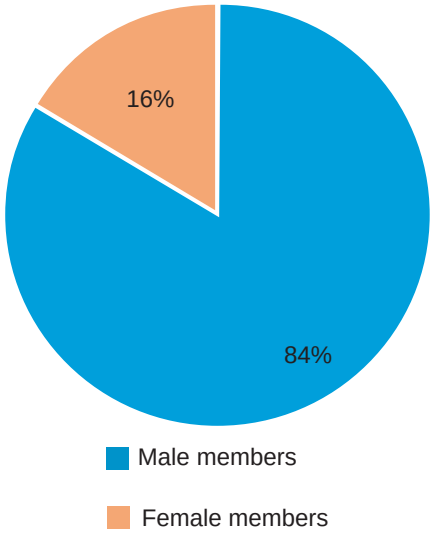

Figure 1 Gender of WUC members (n = 2,237)

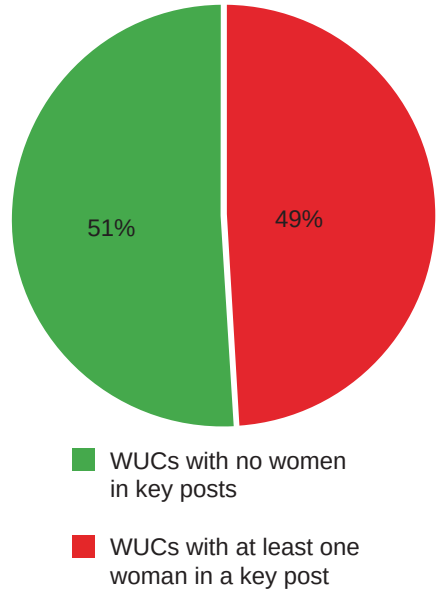

Figure 2 Water User Committees with at least one woman holding a key post (n = 365)

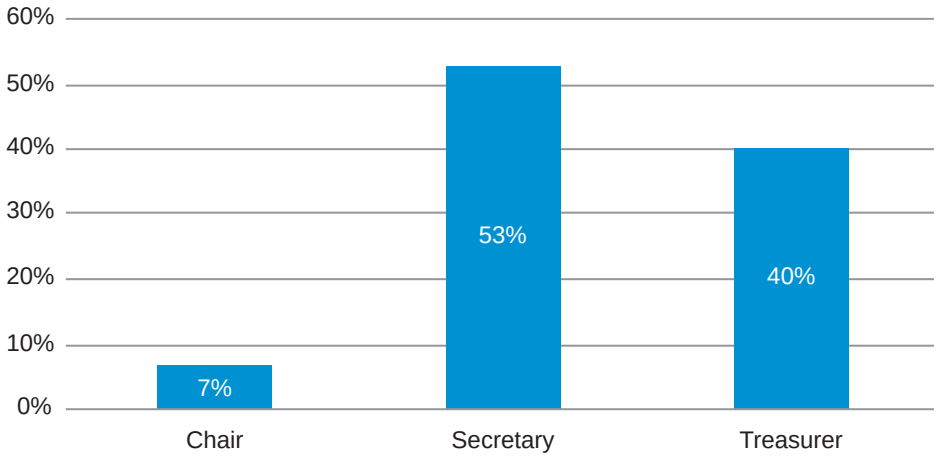

Figure 3 Key posts held by women in the Water User Committee (n = 186)

Further analysis was carried out to understand if the type of key role would affect the frequency of meetings (see Figure 5). Meetings were more likely to occur more than once a year when there was a female chair (53 per cent; t (86) = 1.86, $p<0.05$) or secretary (50 per cent; t (171) = 2.98, $p<0.01$), compared with a female treasurer (28 per cent).

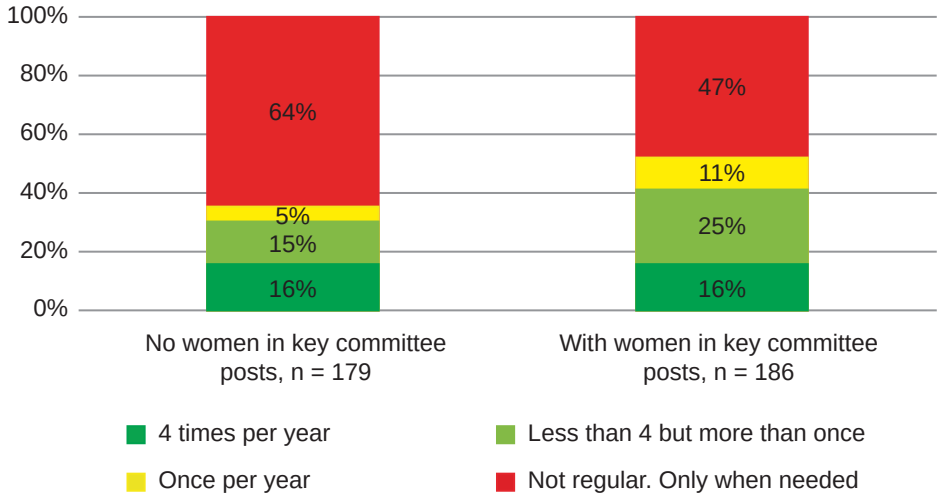

Figure 4 Frequency of meetings for WUCs with and without women in key posts

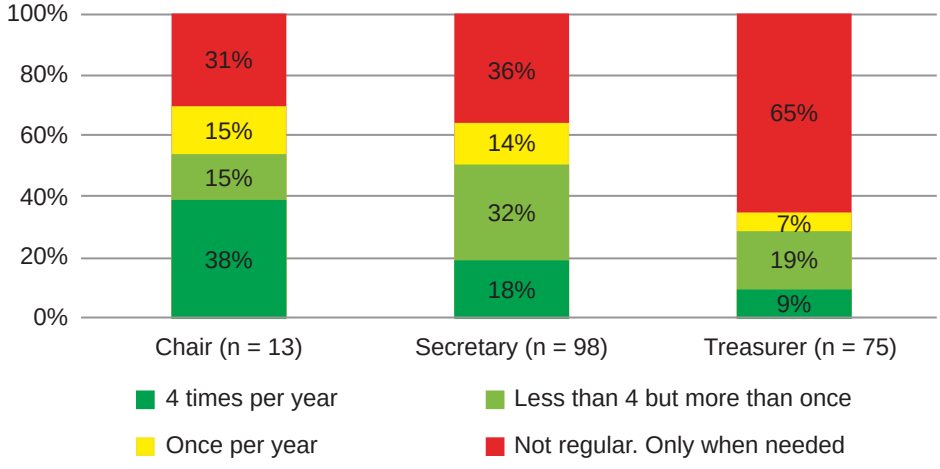

Figure 5 Frequency of meetings for WUCs with women in key posts, by role

From all the 365 WUCs, approximately half (52 per cent) of the WUCs collected revenue on a regular basis, 40 per cent reported not collecting regular revenue and 8 per cent indicated funding from special events. When revenue was collected, it was less than US$10 per household, in the majority of cases (86 per cent). There was significantly more regular revenue collection by WUCs with women in key posts than those without (61 per cent compared to 42 per cent, X^2 (1, N = 365) = 12.2 , p<0.01). Similarly, committees with men in all key posts were more likely to have *no* user fees collected compared to those with women in these roles (51 per cent compared to 28 per cent, t (363) = 4.5, p = 0.00) (see Figure 6). No difference was found between gender participation and the value of revenue collection.

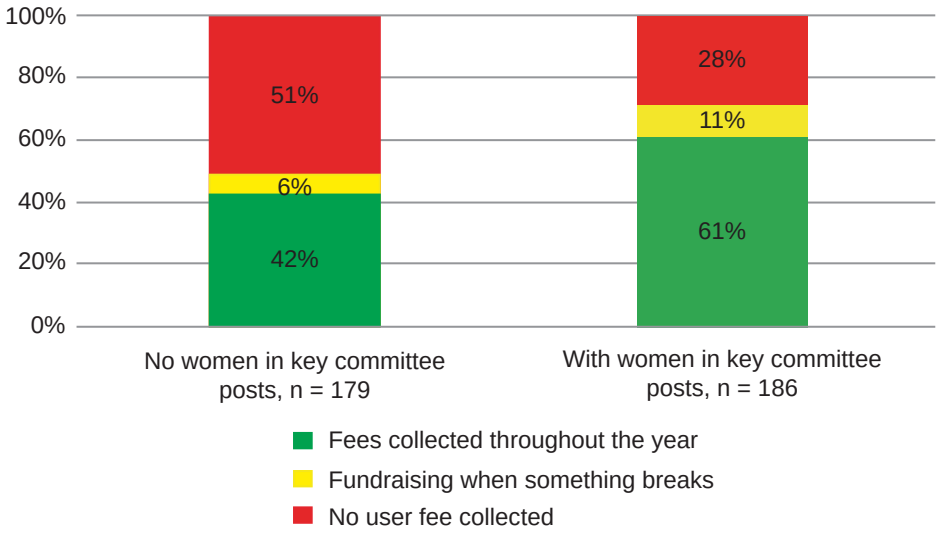

Figure 6 Revenue collection by WUCs with and without women in key posts

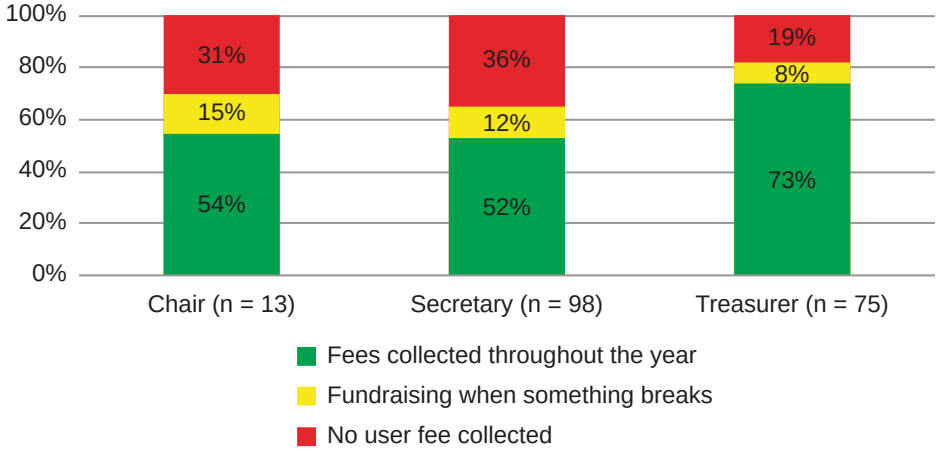

Figure 7 Revenue collection by WUCs with women in key posts, by role

Further analysis was done to understand whether the type of key post is associated with a different revenue collection, as displayed in Figure 7. Regular user fee collection takes place more often when there is a female treasurer (73 per cent), compared with a female chair (54 per cent) and secretary (52 per cent). This difference is significant with the secretary (52 per cent; t (171) = 2.90, p<0.01) and, to a lesser extent, with the chair (54 per cent; *t* (86) = 1.42, p<0.10).

Of the 186 WUCs with women in key positions, 43 per cent of the systems were in good condition, 35 per cent in fair condition, and about 22 per cent in poor condition or not working at all. Similarly, of the 179 with only men in key posts, 35 per cent were in good condition, 29 per cent in fair condition, and 36 per cent in

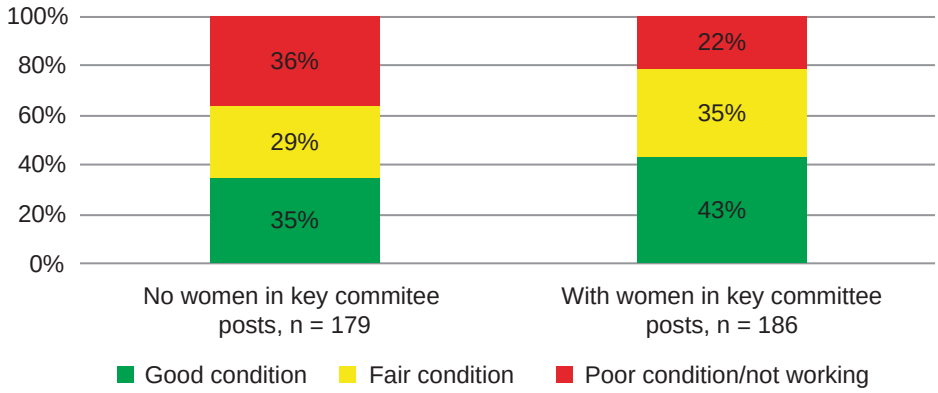

Figure 8 Water system functioning of a WUC, with or without women in a key post

poor condition or not working at all (Figure 8). Further analysis shows that WUCs with no women in key posts were also significantly more likely to function poorly or not at all compared to those that included women: 36 per cent compared to 22 per cent (t (363) = 3.16, p = 0.00).

Further analysis was carried out to determine whether the overall functioning of a system would differ depending on the key posts held by women. WUCs with female treasurers (15 per cent) and chairs (15 per cent) had half the frequency 'poor and not working systems' compared with the WUCs with a female secretary (28 per cent) (see Figure 9). This difference in functionality between the treasurer and the secretary is significant (15 per cent; t (171) = 2.04, p<0.05). The difference between chair and secretary was not significant, probably because of the small sample size of the female chair.

Results of multivariate regression analysis show that participation of women in WUCs is a significant predictor of functionality of the water system even after controlling for other factors such as system type, size, or age (see Table 4). Water systems that have WUCs with women occupying key positions were 11 per cent [95 per cent CI = (0.060, 0.155)] more likely to be functioning compared to those without women in key positions. Simple rainwater systems were found to be more likely to function compared to piped systems [95 per cent CI = (0.094, 0.226)]. There was no significant difference in functionality between a piped system and spring, well, or borehole water systems. System size was found not to be a significant predictor of functionality. Older systems were less likely to be functioning than newer systems. Of the systems installed before 1990, 32–44 per cent were likely to not function compared to approximately 22 per cent of those installed from 1990 onwards.

Discussion

Analysis of water census data reveals that women remain under-represented in WUCs at only 16 per cent of the membership, and only half of the committees have women in key posts. When women are in key posts, they are more likely to have

Table 4 Multiple regression analysis of women's participation in WUC versus functionality of water systems

Variable	*Margins*	*Std err.*	*[95% Conf. interval]*		*P-value*
Women occupying key positions (1 = Yes)	0.107***	0.024	0.060	0.155	0.000
Type of system (Ref. = Piped system)					
Rainwater	0.160***	0.034	0.094	0.226	0.000
Spring/well/borehole	–0.077	0.058	–0.190	0.037	0.186
Number of people dependent on the system (Ref. = 1–51)					
51–100	–0.092	0.073	–0.234	0.050	0.205
101–150	0.002	0.105	–0.203	0.208	0.983
151–200	0.065	0.067	–0.066	0.196	0.333
201–250	–0.097	0.064	–0.223	0.029	0.132
>250	0.061	0.071	–0.080	0.201	0.397
Year when system was installed (Ref. =2010–2015)					
2000–2009	–0.218**	0.088	–0.391	–0.045	0.014
1990–1999	–0.223***	0.081	–0.382	–0.064	0.006
1980–1989	–0.435***	0.028	–0.490	–0.380	0.000
<1980	–0.321***	0.043	–0.405	–0.236	0.000

Note: Reference (Ref.) categories are shown in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Marginal effects from logit model are presented. Standard errors are adjusted for clustering at province level.

the roles of secretary or treasurer, and less likely to lead the committee as chairperson. Studies from other parts of the world that have examined women's participation in water committees have varied greatly in their findings but also generally found women to be under-represented. A 2009 study from South Africa reported a similar level of female membership, 14 per cent, with none of the committees meeting the national requirement for a neutral gender balance (Mjoli et al., 2009). An earlier evaluation of 88 water committees, in Latin America, Africa, and Asia, reported women to be over-represented in 15 per cent of committees; 39 per cent had gender balance; women were under-represented in 37 per cent; and 9 per cent included no women (van Wijk-Sijbesma, 2001).

In Peru, a law promoting equal opportunities for women and men led to local government reforms in water management and equal representation in oversight boards (Water and Sanitation Program, 2010). In Timor-Leste, where the government mandates participation of women in water committees (GMFs), a 2012 programme report indicated that 31 per cent of committee members were women, 97 per cent of new GMFs had women in technical or management positions, and 14 per cent of committee leaders were women (International Development Support Services, 2012). Another report from Timor-Leste stated that only 35 per cent of committees had equal participation of women and men (Whalen and Belo, 2013). In Uganda, the development of a Water Sector Gender Strategy has led to improved

gender balance in water committees and improved representation of women in managerial roles (WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation, 2010; Carrard et al., 2013). A recent report stated that 84 per cent of the committees had women in key posts (Ministry of Water & Environment, 1999, 2015). These country results support the conclusion that government decrees on women's participation do not guarantee their active involvement in water management. It has been suggested, in a UNICEF-commissioned study to improve gender equality in WASH in Vanuatu, that strengthening of legal frameworks on water and gender must be supported by building sector capacity and improving monitoring and evaluation of gender in WASH (Peacock, 2015).

Tools to assist in the planning, monitoring, and evaluation of gender in WASH have been developed by several civil society and academic organizations. Plan International have developed a gender and WASH monitoring tool, of participatory rural appraisal activities and preparatory training, which enables project staff and government partners to explore and monitor gender relations in the implementation of WASH activities (Plan International, 2014). The Institute of Sustainable Development has also produced a toolkit to guide more gender-responsive WASH interventions that includes participatory planning and monitoring tools (Institute for Sustainable Futures, 2010). The Asian Development Bank has also published a comprehensive toolkit of programme and project level results and indicators to evaluate gender equality results, which includes a chapter on WASH, and a gender in WASH checklist is planned to be published by UNICEF in 2017 (Asian Development Bank, 2013). Key to the determination of gender in programming is the assessment of equal status, opportunities, outcomes, and rights for males and females, including in decision-making (Moser, 1993; CARE, 2012; Asian Development Bank, 2013).

Findings from this study suggest that involvement of women in key roles in the water committees may be associated with more regular meetings and revenue collection. Water system performance also appears to be improved when women hold these key roles. The type of role held by women appears to influence these improvements in performance. Meeting regularity was found to be better when women held the key posts of committee chair or secretary compared with that of treasurer. Since the chair and secretary are more likely to be tasked with community mobilization, it would seem logical that their efforts are more likely to drive more regular meetings. Similarly, when women held the role of treasurer, rather than chair or secretary, revenue collection was found to be greater. Improved functionality of the water systems was also more likely if women held the more influential roles of chair or treasurer. These findings would appear to support a link between female leadership, in key roles, and improved water management and functioning. While causality cannot be explicitly determined from this analysis, these results are in keeping with those from other countries.

The study of water committees in Latin America, Africa, and Asia found that those with at least 40 per cent female membership scored significantly better in budgeting and accounting functions, and had water systems with less leakage (van Wijk-Sijbesma, 2001). The review in Timor-Leste found women's full

participation in water committees to be associated with much better functionality than those with limited participation of women (Whalen and Belo, 2013). The study from Uganda reported significantly better functioning of hand pumps when women were in water committee key posts, and another from the Dominican Republic found a positive correlation between water system sustainability scores and women's participation in water committees (Foster, 2013; Schweitzer, 2013). There is a need for more standardized data collection on gendered participation in water management, water system functioning, and sustainability to confirm these positive results and better understand them.

The findings from the Vanuatu analysis were presented at a gender workshop for provincial staff of the Vanuatu Ministry of Lands and Resources, Department of Geology, Mines & Water Resources (DGMWR). Informal feedback from DGMWR staff, who engage with WUCs, supported the finding of under-representation of women in committees, with participation varying across provinces and islands. Participants reported barriers to women's involvement generally related to cultural norms of men as decision-makers. The stakeholders suggested measures to overcome these barriers, including ensuring female DGMWR staff at the provincial level, identifying and using female role models from the community, and developing general awareness of the positive contributions made by female leadership. These positive contributions, as identified by the stakeholders, included women being more proactive implementers, good community mobilizers, more skilled at fund collection and management, and more trustworthy. This is in keeping with previous research, which has found that putting women at the centre of WASH improvements leads to better service provision as their input improves design, planning, and maintenance; they provide greater transparency and accountability in management and improved fund administration (Fisher, 2006). More research is needed to better understand the role women play in WUCs and the impact they have on well-functioning committees and water systems.

Conclusion and Recommendations

Women remain under-represented in the water committees of Vanuatu. However, findings from this analysis suggest that their participation in key committee roles may be associated with improved functioning of both water committee and water system. The results from this study have provided an opportunity to engage staff from government departments in discussions regarding gender equality and the importance of women's participation.

Following this study and discussions with the Department of Geology, Mines & Water Resources, there has been an amendment to the Water Resources Management Act (December 2016) mandating that at least 40 per cent of the members of Rural Water Committees must be women. A greater gender focus has also been suggested to be included in the water policy, which is currently under development. In addition, the Department of Women's Affairs intends to utilize the findings of this study to lobby for greater gender equality in other government departments and committees. Future amendments to the Vanuatu National Gender Equality

Policy could include directives to support this. The inclusion of gender targets in management, including water committees, provides opportunities to improve women's active participation and empowerment, while also improving effectiveness of programmes. To ensure these efforts do not only result in tokenistic representation, it will be important that they are supported with sector capacity building, opportunities for paid employment for women, and further monitoring and evaluation.

Greater community engagement and capacity building will be key to furthering gender equality in water management in Vanuatu, and DGMWR training should include attention to gender and the value of women's participation. It will also be important for the DGMWR to consider gender balance in female programme staff and the Provincial Water Advisory Committee. Proactive efforts may be needed to attract women to these roles. It will be important to take steps to ensure that women's increased participation in management positions does not negatively impact their personal safety. In addition, examples of female role models should be identified, documented, and shared, including as resources in peer-to-peer learning.

A global, systematic review of women's participation in water management, and the impact they have on water system functioning, is recommended to better understand the data available. There is also a need to develop a global knowledge base and standardized indicators for water management and functioning that allow for ongoing and comparative monitoring and evaluation. This evidence base will better direct advocacy efforts for policies and practices that improve both gender equality and water system functioning.

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References

Acey, C. (2010) 'Gender and community mobilisation for urban water infrastructure investment in southern Nigeria', *Gender & Development* 18(1): 11–26 <http://dx.doi.org/10.1080/13552071003599970>.

Aladuwaka, S. and Momsen, J. (2010) 'Sustainable development, water resources management and women's empowerment: the Wanaraniya Water Project in Sri Lanka', *Gender & Development* 18(1): 43–58 <http://dx.doi.org/10.1080/13552071003600026>.

Arku, F.S. (2010) 'Time savings from easy access to clean water: implications for rural men's and women's well-being', *Progress in Development Studies* 10(3): 233–46 <http://dx.doi.org/10.1177/146499340901000303>.

Asian Development Bank (2013) *Tool Kit on Gender Equality Results and Indicators* [pdf], Mandaluyong City, Philippines: Asian Development Bank <https://www.oecd.org/derec/adb/tool-kit-gender-equality-results-indicators.pdf> [accessed 20 May 2017].

Brocklehurst, C. and Bartram, J. (2010) 'Swimming upstream: why sanitation, hygiene and water are so important to mothers and their daughters', *Bulletin of the World Health Organization* 88(7): 482 <http://dx.doi.org/10.2471/BLT.10.080077>.

CARE (2012) *Good Practices Framework: Gender Analysis*. Australia: CARE.

Carrard, N., Crawford, J., Halcrow, G. and Willetts, J. (2013) 'A framework for exploring gender equality outcomes from WASH programmes', *Waterlines* 32(4): 315–33 <http://dx.doi.org/10.3362/1756-3488.2013.033>.

Department of Geology, Mines & Water Resources (2008) *Vanuatu National Water Strategy 2008–2018* [pdf], Port Vila: Government of Vanuatu <http://nab.vu/sites/default/files/nab/documents/03/04/2014%20-%2012%3A37/national_water_strategy_-_finalsmall.pdf> [accessed 20 May 2017].

Devasia, L. (1998) 'Safe drinking water and its acquisition: rural women's participation in water management in Maharashtra, India', *International Journal of Water Resources Development* 14(4): 537–46 <http://dx.doi.org/10.1080/07900629849169>.

Enabor, B. (1998) 'Integrated water management by urban poor women: a Nigerian slum experience', *International Journal of Water Resources Development* 14(4): 505–12 <http://dx.doi.org/10.1080/07900629849132>.

Fagan, G.H., Linnane, S., McGuigan, K.G. and Rugumayo, A.I. (2015) *Water Is Life: Progress to Secure Safe Water Provision in Rural Uganda* [online], Rugby, UK: Practical Action Publishing <www.developmentbookshelf.com/doi/book/10.3362/9781780448893> [accessed 24 October 2016].

Fisher, J. (2006) *For Her it's the Big Issue: Putting Women at the Centre of Water Supply, Sanitation and Hygiene* [pdf], Water, Sanitation and Hygiene Evidence Report. Geneva: Water Supply and Sanitation Collaborative Council <https://dspace.lboro.ac.uk/dspace-jspui/bitstream/2134/9970/20/wsscc_for_her_its_the_big_issue_evidence_report_2006_en.pdf> [accessed 20 May 2017].

Fisher, J. (2008) 'Women in water supply, sanitation and hygiene programmes', *Proceedings of the Institution of Civil Engineers - Municipal Engineer* 161(4): 223–9 <http://dx.doi.org/10.1680/muen.2008.161.4.223>.

Foster, T. (2013) 'Predictors of sustainability for community-managed handpumps in sub-Saharan Africa: evidence from Liberia, Sierra Leone, and Uganda', *Environmental Science & Technology* 47(21): 12037–46 <http://dx.doi.org/10.1021/es402086n>.

Institute for Sustainable Futures (2010) *Working Effectively with Women and Men in Water, Sanitation and Hygiene Programs: Learnings from Research on Gender Outcomes from Rural Water, Sanitation and Hygiene Projects in Vanuatu and Fiji* [pdf], Sydney, Australia: University of Technology <https://opus.lib.uts.edu.au/handle/10453/17300> [accessed 20 May 2017].

International Development Support Services (2012) *East Timor Rural Water Supply & Sanitation Programm (2007–2012) (Bee, Saneamentu no ljene iha Komunidade [BESIK])* [pdf], Activity Completion Report, AusAID <https://dfat.gov.au/about-us/publications/Documents/besik-activity-completion-report.pdf> [accessed 20 May 2017].

Kilsby, D. (2012) *'Now We Feel like Respected Adults': Positive Change in Gender Roles and Relations in a Timor Leste WASH Program* [pdf], Research Report, Timor-Leste: Women's Development Agency & WaterAid <https://acfid.asn.au/sites/site.acfid/files/resource_document/Positive-change-in-gender-roles-and-relations.pdf> [accessed 20 May 2017].

Michael, B.P. (1998) 'The role of women in water resources management: the Tanzania case', *International Journal of Water Resources Development* 14(4): 499–504 <http://dx.doi.org/10.1080/07900629849123>.

Ministry of Water & Environment (1999) *The Republic of Uganda: A National Water Policy* [pdf], Kampala <http://extwprlegs1.fao.org/docs/pdf/uga158331.pdf> [accessed 20 May 2017].

Ministry of Water & Environment (2015) *Water and Environment Sector Performance Report 2015* [pdf], Kampala: The Republic of Uganda <www.mwe.go.ug/index.php?option=com_docman&task=doc_download&gid=826&Itemid=55> [accessed 20 May 2017].

Mjoli, N., Nenzhelele, R. and Njiro, E. (2009) *Assessment of Gender Equity in Water User Associations* [pdf], Gezina: Water Research Commission <www.wrc.org.za/Knowledge%20Hub%20Documents/Research%20Reports/KV-219-09.pdf> [accessed 20 May 2017].

Moser, C. (1993) *Gender Planning and Development: Theory, Practice & Training*, London & New York: Routledge.

National Statistics Office (2013) *Vanuatu Demographic and Health Survey 2013* [pdf], Port Vila: Secretariat of the Pacific Community <https://sdd.spc.int/images/documents/Collections/21_Vanuatu/DHS/2013/Report/2013_VDHS_FINAL_17_Feb_2015.pdf> [accessed 20 May 2017].

Peacock, C. (2015) *Gender Equity and Social Inclusion in the WASH Sector in Vanuatu: Assessment of Gender Mainstreaming by WASH Policy-Makers and Service Providers and Recommendations to Strengthen Programming by Sector Stakeholders*, Port Vila: UNICEF Pacific.

Plan International (2014) *Gender and WASH Monitoring Tool* [pdf], Australia: Plan International <https://www.plan.org.au/~/media/plan/documents/resources/gwmt-march-2014.pdf> [accessed 20 May 2017].

Ray, I. (2007) 'Women, water, and development', *Annual Review of Environment and Resources* 32(1): 421–49 <http://dx.doi.org/10.1146/annurev.energy.32.041806.143704>.

Remigios, M.V. (2011) 'Women – water – sanitation: the case of Rimuka high-density suburb in Kadoma, Zimbabwe', *Agenda* 25(2): 113–21 <http://dx.doi.org/10.1080/10130950.2011.576004>.

Schweitzer, R. (2013) *Community and Household Management Strategies for Water Supply and Treatment in Rural and Peri-urban Areas in the Developing World* [online], PhD dissertation, University of South Florida <http://scholarcommons.usf.edu/etd/4765> [accessed 20 May 2017].

United Nations Department of Economic and Social Affairs (2005) *Women and Water* [pdf], New York: United Nations <www.un.org/womenwatch/daw/public/Feb05.pdf> [accessed 20 May 2017].

Upadhyay, B. (2004) *Gender Roles and Multiple Uses of Water in North Gujuarat* [pdf], Colombo, Sri Lanka: International Water Management Institute <www.iwmi.cgiar.org/Publications/Working_Papers/working/WOR70.pdf> [accessed 20 May 2017].

Vanuatu Ministry of Health (2007) *Monitoring the Situation of Children and Women: Vanuatu Multiple Indicator Cluster Survey* [pdf], Port Vila: Government of the Republic of Vanuatu <www.unicef.org/pacificislands/MICS_Reportsmla.pdf> [accessed 20 May 2017].

van Wijk-Sijbesma, C. (2001) *The Best of Two Worlds? Methodology for Participatory Assessment of Community Water Services* [pdf], The Hague, Netherlands: International Water and Sanitation Centre <www.ircwash.org/sites/default/files/irc-2001-the_best.pdf> [accessed 20 May 2017].

Water and Sanitation Program (2010) *Mainstreaming Gender in Water and Sanitation*, Working Paper, Washington, DC: World Bank.

Watts, S. (2004) 'Women, water management, and health', *Emerging Infectious Diseases* 10(11): 2,025–6 <http://dx.doi.org/10.3201/eid1011.040237>.

Whalen, M. and Belo, C. (2013) *GMF Study: What is the situation of GMFs in Timor-Leste?* Dili: BESIK.

WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation (2010) *Progress on Sanitation and Drinking Water 2010 Update* [pdf], Geneva: WHO <https://www.unicef.org/eapro/JMP-2010Final.pdf> [accessed 20 May 2017].

Willetts, J., Halcrow, G. and Carrard, N. (2009) *How Do We Better Address Gender in Pacific Water and Sanitation Initiatives? Vanuatu Case Study* [pdf], Research Project, Port Vila: Live & Learn Environment Education <www.genderinpacificwash.info/system/resources/BAhbBlsHOgZmIjwyMDExLzAxLzExLzIxLzMyLzQ5Lzc3Ni9pc2ZfaXdkYV92YW51YXR1X2Nhc2Vfc3R1ZHkucGRm/isf_iwda_vanuatu-case-study.pdf> [accessed 20 May 2017].

World Health Organization (2012) *GLAAS 2012 Report: The Challenge of Extending and Sustaining Services* [pdf], Geneva: WHO <www.un.org/waterforlifedecade/pdf/glaas_report_2012_eng.pdf> [accessed 20 May 2017].