Water Policy 15 (2013) 61–78

Meeting the water and sanitation MDGs: a study of human resource development requirements in Tanzania

Richard Kimwaga[a,*], Joel Nobert[a], Victor Kongo[a] and Mpembe Ngwisa[b]

[a]*Water Resources Engineering Department, University of Dar es Salaam, P.O. Box 35131, Dar es Salaam, Tanzania*
**Corresponding author. E-mail: rkimwaga2007@yahoo.com*
[b]*Pöyry Tanzania Ltd, P.O. Box 32334, Dar es Salaam, Tanzania*

Abstract

In the Tanzanian water and sanitation (WatSan) sector, the human resource (HR) requirements for meeting the Millennium Development Goal (MDG) targets have so far been relatively unknown. This study was therefore conducted with a focus on determining HR requirements in the public sector and parastatal institutions, in the private sector (private consultancy companies, individual contractors, etc.), and in non-governmental organizations and community-based organizations active in the broader water, sanitation and hygiene (WASH) sector. The competences assessed were: design and construction of new infrastructure, operation and maintenance (O&M), community mobilization, sanitation, and hygiene promotion. The study found a greater HR shortage in rural areas than in urban areas. The smallest HR need is for social development professionals (estimated at 320 in the urban areas). In the water supply and sanitation sectors, the average number of water supply engineers that will be required to achieve MDGs is estimated at 3,864, compared to the sanitation sector, which will need 637 engineers. In terms of the demand for competences in the water supply sector, the highest need is for O&M professionals (7,589) and the lowest for mobilization professionals (447). The study recommends increasing the HR supply in the WatSan sector through the following measures: increasing support for training institutions offering relevant courses in WatSan; focusing on skills required for asset management and O&M; and giving specific attention to HR capacity development in small towns and rural areas.

Keywords: Competences; Human resource demand; Human resource gap; Human resource requirements; Human resource supply; Millennium Development Goals (MDGs); WASH; WatSan

1. Introduction

In 2006, the World Health Organization's World Health Report estimated that 4.3 million additional health workers would be needed worldwide to achieve the health-related Millennium Development

doi: 10.2166/wp.2013.012

© IWA Publishing 2013

Goals (MDGs). Subsequently, in 2008, UNESCO estimated that 18 million new teachers would be needed to meet the MDG of achieving universal primary education. Yet in the water and sanitation (WatSan) sector, the human resource requirement to meet the MDG targets is relatively unknown, and therefore there is a need to assess the constraints to meeting the MDGs and sustaining services in terms of the number of staff, their qualifications and practical experience. In 2005, a study was conducted in Tanzania to assess the human resource needs for water resources management and development. However, the study did not focus on assessing these needs in relation to meeting the MDGs.

The current institutional framework for the provision of water supply and sanitation services in Tanzania is based on a separation between urban water supply and sewerage services on the one hand, and rural water supply and sanitation services on the other. WatSan is therefore rather complex to implement, both in law and in practice. Urban and rural service provisions have a number of overlapping responsibilities, duplications and omissions. Furthermore, the mechanisms for effective consultation, consensus building and participation of stakeholders in the decision-making process are not adequately defined and are hence a challenge to implement.

2. Objective of the study

The main objective of this study was to assess human resources (HR) that would be required in the water, sanitation and hygiene (WASH) sector to be able to achieve the water and sanitation services MDGs in Tanzania. In addition, the methodology adopted in this Phase II study also estimated the HR requirements to achieve full coverage of water supply and sanitation for the predicted population in 2015. The study focused on the HR requirements in the public sector and parastatal institutions, in the private sector (private consultancy companies, individual contractors, etc), and in non-governmental organizations (NGOs) and community-based organizations (CBOs) active in the WASH sector.

In order to achieve the main objective of this study, the following sub-objectives were developed:

- estimate the 2015 population in Tanzania by factoring in population growth;
- determine the current WatSan coverage and calculate the expansion needed to achieve (a) MDGs and (b) full service coverage;
- estimate a proxy of HR demand per type of service delivery for 10,000 people;
- determine the existing HR capacity in the country in terms of numbers and skill;
- assess the HR supply in the years up to 2015 in terms of graduates as well as on-the-job training;
- calculate the HR shortages and assess the HR gaps; and
- determine ways in which HR development institutions can address the shortages and gaps, as well as provide recommendations for alternative ways to fill these shortages and gaps.

2.1. Key competences identified

Key WatSan competences required to meet the MDGs in Tanzania were identified and are highlighted below:

(i) *Water and sanitation engineer*: a person who is qualified or professionally engaged in the branch of engineering specifically related to the provision of water and sanitation facilities or infrastructure (e.g. civil/environmental engineers).
(ii) *Other engineer:* a person who is qualified or professionally engaged in another branch of engineering that is required in the planning, design or operation of water and sanitation facilities or infrastructure (e.g. hydro-geologists, mechanical/electrical engineers).
(iii) *Management and finance professional*: a person who is qualified or professionally engaged in management and finance (e.g. finance, HR and strategic managers, as well as office managers with administrative functions), a person who procures goods and services, or a budget planner.
(iv) *Social development professional:* a person who is qualified or professionally engaged in hygiene promotion or other relevant water, sanitation and health professions in the social sciences (e.g. health promotion specialist, sociologist, community development worker).

3. Methodology

3.1. Methodological framework

This study was carried out using a methodological framework that was developed by IWA based on the results of the Phase I study. The methodological framework is as described in IWA (2012) and is presented below in Figure 1. The methodology was designed to calculate both current and expected additional HR requirements based on an assessment of existing service coverage and future targets,

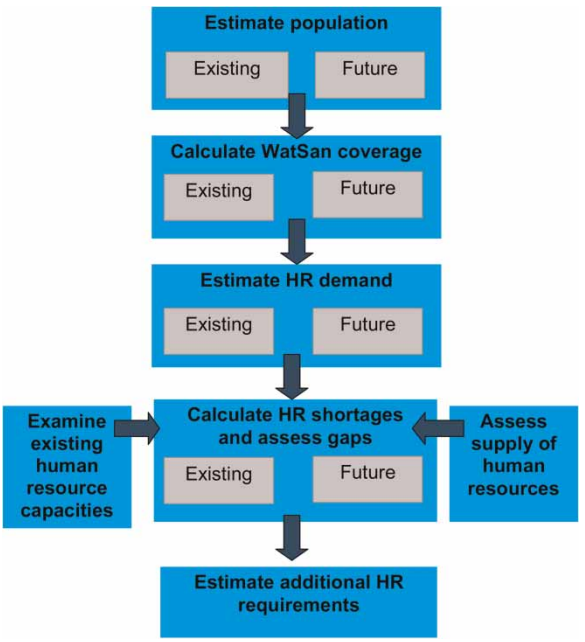


Fig. 1. Methodological framework.

the existing availability of WASH professionals and their future supply to the market. The methodology in Phase II is based upon the methodological framework developed in Phase I, but with a number of adaptations and clarifications. The seven elements are summarized in the IWA report (IWA, 2012).

The methodology in Phase II aimed to make a clearer distinction between HR requirements for:

(a) design and construction of new infrastructure;
(b) operation and maintenance (O&M); and
(c) community mobilization, WASH promotion.

3.2. Study area

The study was undertaken in Tanzania. It is important to emphasize that the study was only carried out in some sampled areas (see Figure 2).

3.3. Sampling of NGOs involved in WASH

NGOs in the WASH sector were identified with support from the Tanzania Water Supply and Sanitation Network (TAWASANET), where it was established that there are 40 member NGOs dealing with WatSan and 15 CBOs dealing with hygiene promotion. Random sampling was made, with the NGOs representing both rural and urban settings. A total of 13 NGOs representing about 33% of all NGOs were sampled and contacted during the study. It is useful to note that it was the recommendation of the client of this study (IWA-CapNet) that the number of NGOs to be contacted should not exceed 15. Figure 2 shows that the study managed to have a good sample, representing wide geographical coverage and different work settings (in both rural and urban areas).

3.4. Sampling of private sector organizations involved in WASH

The study ensured that different types of organizations falling within the private sector were well represented. Private sector organizations in the WASH sector (including contractors, consultants and service providers) were identified and their numbers estimated. The various registration boards for both contractors and consultants were contacted for verification purposes and also to obtain more information on other organizations that were not previously identified or listed. Through guidance from the various registration bodies, a detailed list of companies working solely on WASH was drawn up, from which a sample list was established. The level of experience of researchers and consultants in the various organizations was used as the criterion with which to draw up a sample list of specialized service providers in the private sector to be engaged in the study. The sample of private organizations was comprised of three consultants, three contractors and two service providers.

3.5. Sampling of public sector organizations

Sampling in the public sector included the national line agencies responsible for the WASH sector in the country. The public organizations sampled included those at the national level, as well as Local Government Authorities (LGAs).



Fig. 2. Study and sampling area.

3.6. Other data sources and a semi-structured interview/survey

The main method of primary data collection used was a set of structured questions in a questionnaire, which was prepared and sent or administered to the sampled organizations in all sectors (NGOs, private and public sectors). Two workshops were also conducted: one during the inception phase, which aimed at awareness creation, presentation of the methodology and also gaining some basic information and sources from the key stakeholders (see Figure 3); and a second during the validation phase, which aimed at validating the findings/results.

3.7. Key assumptions of the study

It was important to make a distinction between the water supply sector and the sanitation sector. In this study, we assumed that for water supply 10% of time was spent on design and construction, while 85% of time was spent on O&M and 5% of time on promotion. For the sanitation sector, the study assumed that 20% of the time is used for construction, 5% on O&M and 75% of time on promotion.

4. Results and discussion

4.1. Existing and future populations in urban and rural areas

In order to estimate the human resource requirements, it was important to know the populations in different settings in Tanzania. The population distribution in Tanzania is summarized in Figure 4. The current population of Tanzania stands at 43,739,000, with the majority (72%) living in dispersed rural communities.

According to JMP (2010), the future annual population growth rates for Tanzania for different settings, i.e. rural and urban, are projected to be 2.2 and 4.5%, respectively. Using these projections, the population in Tanzania by 2015 (the target for MDGs), was estimated to be 49,914,707 persons, with a distribution as indicated in Table 1.

4.2. Main types of improved water and sanitation service provision used in Tanzania

In order to identify the key competences in WatSan, it is important to know the WatSan technologies currently used in Tanzania; in fact, only three technologies are used (summarized in Table 2). It is also important to identify the key competences needed to operate them, and we have categorized two types of competences, namely:

(i) those needed to create the facilities (water supply and sanitation) *in situ*; and
(ii) those necessary for the sustainability of the facilities.

The first category includes the design and construction of new facilities, while the second comprises O&M, community mobilization, sanitation and hygiene promotion. Community mobilization is important, as it entails awareness creation and ownership of the facilities.



Fig. 3. Presentations and discussions during the inception workshop in Dar es Salaam.

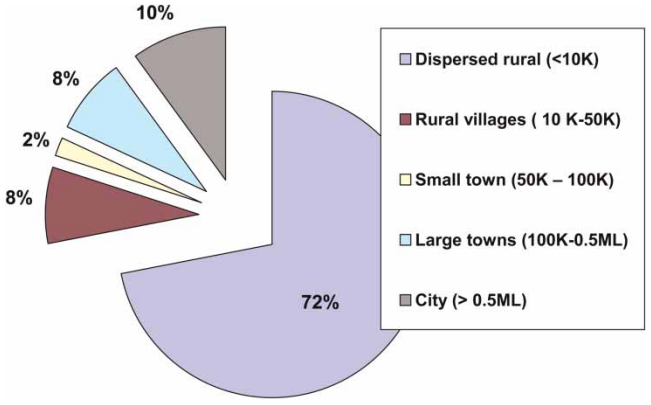


Fig. 4. Population distribution in Tanzania (*Source:* data from WHO, 2011).

4.3. Existing and MDG water and sanitation coverage in diverse settlements

The requirement for WatSan facilities, for both rural and urban areas, was estimated using the existing coverage of water supply and sanitation. The MDG targets for Tanzania were calculated based on the 2000 baseline information and the WatSan percentage that would be covered if the MDGs are achieved.

Table 1. Projected population in 2015.

Setting Category	Population
Dispersed communities	35,112,021
Rural villages	3,901,336
Small towns	1,090,135
Large towns	4,360,540
Cities	5,450,675
Total population	**49,914,707**

Table 2. Water supply and sanitation technologies used in Tanzania.

Serial No.	Water supply technologies	Sanitation technologies
1	Protected spring or shallow well with hand pump	Pit latrines (improved)
2	Piped scheme distributing water from borehole or spring to village or small town	Septic tanks and soak away pits
3	Piped scheme distributing water from surface source (lake, dam or river), used mainly for town and urban water supply	Sewerage systems

Figure 5 summarizes the existing coverage and MDG WatSan targets for Tanzania in both rural and urban settings.

Using the MDG targets and applying the methodological framework, the HR deficit for achieving MDGs in various population settings and the HR deficit for achieving full coverage of WatSan in Tanzania were estimated, as indicated in Tables 3 and 4, respectively.

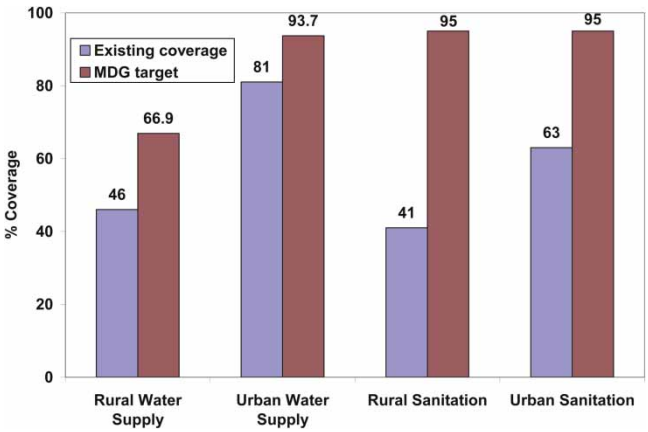


Fig. 5. Existing and MDG target coverage for WatSan facilities in different settings in Tanzania (*Source:* data from WHO/UNICEF, 2010).

Table 3. Population still needing to gain access to water or sanitation to meet MDG goals.

Setting Category	Population
Rural population needing to gain access to water	
Dispersed rural communities	9,003,585
Rural villages	1,000,398
Urban population needing to gain access to water	
Small town	312,885
Large town	1,251,539
City	1,564,424
Rural population needing to gain access to sanitation	
Dispersed rural communities	20,444,667
Rural villages	2,271,630
Urban population needing to gain access to sanitation	
Small town	484,517
Large town	1,938,068
City	2,422,584

Table 4. Population (deficit) still needing to gain access to water or sanitation to achieve full coverage.

Setting Category	Population
Rural population needing to gain access to water	
Dispersed rural communities	20,625,664
Rural villages	2,291,740
Urban population needing to gain access to water	
Small town	381,563
Large town	1,526,253
City	1,907,816
Rural population needing to gain access to sanitation	
Dispersed rural communities	22,200,268
Rural villages	2,466,696
Urban population needing to gain access to sanitation	
Small town	539,024
Large town	2,156,095
City	2,695,118

4.4. Existing human resource demand

The HR demand to achieve the MDGs was calculated based on the existing WatSan coverage in both rural and urban setups in design and construction, O&M and community mobilization. Table 5 highlights the existing HR demands in different settings and presents the nationwide status of the demand for different categories of WatSan professionals, based on serving the existing population (2010 baseline). The existing demand follows the settlement pattern in the country and presents a huge demand for WatSan engineers for dispersed communities nationwide. It was also observed that the comparatively lower number of professionals needed in the engineering category could be attributed to the fact that

Table 5. Existing human resource demand as computed using the methodological framework.

Existing HR Demand Nationwide	WatSan Engineer	Other Engineer	Management & Finance	Social Development
Dispersed communities	7,061	985	4,269	2,791
Rural villages	785	109	474	310
Small towns	785	109	474	310
Large towns	785	109	474	310
Cities	94	13	57	38
Total HR demand	**9,508**	**1,327**	**5,749**	**3,760**

WatSan engineers in Tanzania mostly handle jobs and assignments which would normally be undertaken by a mechanical engineer, a hydrologist or even an electrical engineer.

The low existing HR demand in small towns and cities could be attributed to the fact that the majority of graduate professionals in all categories are attracted to working in the cities and major urban towns. The same trend is observed in companies and NGOs, where most of the programmes and activities are centred in major towns and cities, thus creating the impression of low existing demand in cities, and portraying a huge demand in dispersed rural settlements.

4.5. HR required to achieve the MDGs

Using the existing HR demand (see Table 5) per 10,000 population for different settlements nationwide in different HR categories, it was possible to estimate the HR capacity required to achieve the MDGs using the projected population figures for 2015. Tables 6 and 7 present the HR requirements

Table 6. Future HR needed to achieve the water supply MDGs.

Water Supply Sector: water delivery	WatSan Engineers	Other Engineers	Management & Finance	Social Development
Dispersed rural communities	4,899	490	2,939	735
Rural villages	544	54	327	82
Small towns	213	21	128	32
Large towns	852	85	511	128
Cities	1,065	107	639	160
Total HR demand	**7,574**	**757**	**4,544**	**1,136**

Table 7. HR needed to achieve the MDGs for the sanitation sector.

Sanitation Sector	WatSan Engineers	Other Engineers	Management & Finance	Social Development
Dispersed rural communities	522	348	348	1,913
Rural villages	58	39	39	213
Small towns	16	11	11	59
Large towns	65	43	43	238
Cities	81	54	54	297
Total HR demand	**742**	**494**	**494**	**2,720**

needed to achieve the MDGs by 2015 for the water supply and sanitation sectors, respectively. Taken together, Tables 6 and 7 highlight that the total numbers required to achieve the water supply and sanitation MDGs can be estimated at 8,316, 1,252, 5,039 and 3,856 for WatSan engineers, other engineers, management and finance professionals, and social development professionals, respectively. The high existing HR demand compared to the future demand needed to achieve the MDGs is a result of less coverage needed, given the 2010 vs projected 2015 population figures.

4.6. Current HR supply

The current capacities for training technicians and enrolment levels in the various institutes was studied and analyzed. For institutions that have full registration with the National Council for Technical Education, the total annual training capacity for WatSan-related engineering courses in higher learning institutions is 1,540. This training capacity, together with other related professional courses in all the training institutions, is too low by any standards. Using the synthesized information from different academic (higher learning) institutions and training institutions that offer WatSan-related courses, the study established the current HR supply for WatSan in Tanzania.

From the study, the estimated HR supply of WatSan engineers, other engineers, management and finance professionals and social development professionals in the water sector available to help meet the 2015 MDGs were estimated to be 2,930, 34, 276 and 248, respectively. For the sanitation sector in the same competences, the HR supply was estimated to be 84, 34, 55 and 25, respectively. This shows that more HR are available for the water sector than for the sanitation sector. It is interesting to note that the trend for HR supply in Tanzania for both the water and sanitation sectors is upward. To a large extent, this has been attributed to the higher learning education policy that directs all the institutions in the country to increase the number of students graduating in different disciplines, engineering being one of them. A number of economic development frameworks in the country, as well as the MDGs, call for an increase in the number of graduates by 2015. In 2008, there was also a directive from the President of Tanzania to the Engineers Registration Board (ERB) to increase the number of engineers.

4.7. Quantifying shortages and assessing the gaps to meet MDGs in 2015

4.7.1. The HR demands by broad categories and different settings. The exercise of quantifying the national HR shortages in WatSan started with a quantification of the HR demand in both rural and urban settings for the four identified competences, namely: WatSan engineers, other engineers, management and finance professionals and social development professionals. Table 8 summarizes the future HR demand for both the water supply and sanitation sectors if the MDGs are to be achieved.

Table 8 shows that, for the water supply sector, the HR demand for WatSan engineers is highest (a total of 7,573), with more demand in rural areas, where the majority of the Tanzanian population lives. The lowest HR demand is for social development staff (320), with less demand for the same in urban areas. In the sanitation sector, the highest HR demand is in the social development sector (estimated at 2,126), with the lowest being other engineers and management and finance professionals (each standing at 108). The rural geographic setting has a higher HR demand for sanitation than the urban setting, estimated at 580 and 162, respectively. The results suggest that for sanitation, the most important

Table 8. Future HR demand for WatSan if MDGs are to be achieved.

HR Demand to achieve MDGs	WatSan Engineer	Other Engineer	Management & Finance	Social Development
Water				
Rural	5,443	544	3,266	817
Urban	2,130	213	1,278	320
Total	7,573	757	4,544	1,137
Sanitation				
Rural	580	386	386	2,126
Urban	162	108	108	594
Total	742	494	494	2,720
Grand total	**8,316**	**1,252**	**5,039**	**3,856**

aspect is the software component[1], which is why the demand is higher, whereas for water supply the important aspect is infrastructure.

Quantification of the HR shortages in WatSan in Tanzania was preceded by a quantification of the existing HR for each of the competences of WatSan engineers, other engineers, management and finance professionals and social development professionals, for NGOs and for the private and public sectors. Table 9 summarizes the existing HR for the different sectors and indicates that HR capacity in the water supply sector for the four categories is 780 for WatSan engineers, 128 for other engineers, 470 for finance and management professionals, and 220 for social development professionals, while for the same competences in the sanitation sector these numbers are 21, 16, 20 and 25, respectively. These results show that there is more HR capacity for the water supply than for the sanitation sector, and also show that NGOs have fewer WatSan engineers (80) than there are in the public sector (525). Interestingly, the NGOs have more HR capacity for the sanitation sector than do the private and public sectors. This explains the attention NGOs are able to give to changing behaviour, with regard to sanitation practices and hand washing.

4.7.2. HR shortages in the water supply and sanitation sectors. The current HR shortages for achieving the MDGs in Tanzania are summarized in Table 10. The table indicates that more WatSan engineers (3,864) will be required to achieve the MDGs for water supply than are needed for sanitation (637), but the shortage of social development professionals is greater for sanitation (2,670) than for water supply (669). This explains that, as far as the sanitation sector is concerned, more software components are required than hardware when compared to the water supply sector (where more hardware is required than software). The current low shortage of WatSan engineers in sanitation could be attributed to the fact that, as far as sanitation in concerned in Tanzania, behavioural change is currently more important than putting facilities in place. This is also evidenced by the high shortage of social development professionals in the sanitation sector.

The sector as a whole proved to be short specifically of environmental engineers, programme officers and technical officers within the broader WatSan engineer category. In the social development category, there seemed to be too few sanitation marketing/community empowerment workers. The reasons for

[1] In this context, software components are social economic issues; hardware components refer to the infrastructure setup.

Table 9. Existing HR for WatSan for different competences in Tanzania.

HR Capacity	WatSan Engineer	Other Engineer	Management & Finance	Social Development
NGOs				
Water				
Existing HR capacity in water	80	40	120	120
Sanitation				
Existing HR capacity in NGO sanitation	11	11	15	15
Private Sector				
Water				
Existing HR capacity in private sector organizations in water	175	50	50	25
Sanitation				
Existing HR capacity in private sector organizations in sanitation	10	5	0	10
Public Sector				
Water				
Existing HR capacity in public sector organizations in water	525	38	300	75
Sanitation				
Existing HR capacity in public sector organizations in sanitation	0	0	0	0
Total number working in water	780	128	470	220
Total number working in sanitation	21	16	20	25

Table 10. HR shortages in WatSan to achieve MDGs and full service coverage in Tanzania.

Quantifying the Shortages	WatSan Engineer	Other Engineer	Management & Finance	Social Development
Water Sector				
HR shortage to achieve MDG	3,864	596	3,799	669
HR shortage to achieve full service coverage	6,701	879	5,500	1,094
Sanitation Sector				
HR shortage to achieve MDGs	637	444	419	2,670
HR shortage to achieve full service coverage	676	430	405	2,589

these kinds of gaps in the social development category could be due to the fact that these skills are not taught in the formal system of Tanzanian higher education institutions, which is probably largely due to curricula in the education systems not addressing these skills and knowledge areas. The gap in the number of environmental engineers could be due either to environmental engineers not being interested in working in the water sector or that the water sector does not employ them effectively.

4.7.3. HR shortages in different competences: construction, O&M and community mobilization. In quantifying the HR shortages for different work areas, it was important to apportion the time allocated

for each and, once again, to make a distinction between the water supply sector and sanitation sectors. As highlighted in previous sections, it was assumed that, for the water supply sector, the assigned time used for design and construction is only 10%, while the time for O&M is 85% and the time spent for promotion is 5%. For the sanitation sector the study assumed that 20% of the time is used for design and construction, 5% of the time for O&M, and 75% for promotion. Using this proportion of the assigned time for different competences, the study established the HR shortages as summarized in Table 11.

Table 11 shows that the HR shortages in Tanzania for water supply are highest for O&M (7,589) and lowest for mobilization (estimated at 447). This can probably be attributed to the need for more maintenance of the infrastructure for the sustainability of the services. However, the sanitation sector has the highest HR shortage in mobilization and lowest in O&M, estimated at 3,128 and 77, respectively. This can be explained that the highest shortage for mobilization calls for more software components in sanitation than hardware. The lowest HR shortage, for O&M in sanitation, indicates that a big portion of sanitation technology is not complex enough to require frequent O&M. The high shortage of O&M professionals in the water supply sector could be attributed to the fact that in the classical/traditional delivery of WASH courses, not much emphasis is given to O&M. On the other hand, the high shortage of social development professionals in the sanitation sector could be attributed to not many people in this discipline wanting to work in the sanitation sector because of a lack of incentive to do so, or to sanitation not being competitive economically with other sectors.

4.7.4. Rural vs urban HR capacity shortages. In order to quantify the HR capacity shortages for different settings it was important to look into the proportions of the population living in different settings in Tanzania. It was established that about 80% of Tanzanians live in rural areas, while only 20% live in urban areas. Rural settings include dispersed rural communities of fewer than 10,000 people and rural villages are defined as having populations of between 10,000–50,000, according to the IWA methodology. Populations of more than 50,000 are considered to be urban settings.

Table 12 shows the HR shortages for the different settings and highlights that the highest HR shortage in meeting the MDGs in the water supply sector is for WatSan engineers (estimated at 3,864), the majority of whom are needed in rural settings. The lowest shortage is for other engineers (estimated at 119), mainly in urban settings. In the rural and urban areas, there is an HR shortage of 7,142 and

Table 11. HR shortages for different competences.

	Design/Construction	O&M	Mobilization
Water Supply			
WatSan Engineers	386	3,284	193
Other Engineers	60	507	30
Finance and Management	380	3,229	190
Social Development	67	569	34
Total	**893**	**7,589**	**447**
Sanitation			
WatSan Engineers	127	32	478
Other Engineers	89	22	333
Finance and Management	84	2	314
Social Development	534	21	2,003
Total	**834**	**77**	**3,128**

Table 12. Shortages of HR in urban and rural settings.

Quantifying the Shortages	WatSan Engineer	Other Engineer	Management & Finance	Social Development
Water Sector				
HR shortage to achieve MDGs	3,864	596	3,799	669
Rural	3,091	477	3,039	535
Urban	773	119	760	134
Sanitation Sector				
HR shortage to achieve MDGs	637	44	419	2,670
Rural	510	35	335	2,136
Urban	127	9	84	534

1,786, respectively, to meet the MDGs. This explains the need for having more WatSan engineers in rural areas to put up the relevant facilities. For the sanitation sector, the highest shortage is for WatSan engineers (estimated at 510), of which the majority are needed in rural settings, while the urban setting has an HR shortage of 127. This is probably due to the fact that there currently are no institutions that provide education solely on sanitation. The high shortage of HR in all sorts of jobs in rural settings, for both the water supply and the sanitation sectors, could be due to the fact that many of these professionals would prefer to work in urban areas than rural areas: qualified personnel, especially young and newly trained engineers, prefer to work in urban areas, as they find rural areas to be socially backward and lacking in services.

4.7.5. HR shortages in different types of organizations (NGOs, private, public). In order to establish the HR needs for different types of organizations, it was first important to establish the proportion of existing HR for different organizations within the total available HR pool; see Table 13 for a summary. Table 13 shows that, for the water supply sector, more WatSan engineers are found in the public sector (0.7) than in the private sector (0.11) or in NGOs (0.19). This can be explained by the fact that the public sector is more interested in building water facilities and that the public sector seems to employ many WatSan engineers. This means that more WatSan engineers are currently needed by the public sector than by the NGOs and private sector. However, for the sanitation sector, more WatSan engineers are employed by NGOs (0.5) than in the private (0.48) and public (0.02) sectors. It is, however, interesting to note that for the social development competence, NGOs have a higher proportion of existing HR (0.56 and 0.6 in the water supply and sanitation sectors, respectively) than do the private and public sectors. This

Table 13. Proportion of existing HR for different types of organizations.

Type of Organization	WatSan Engineers	Other Engineers	Management & Finance	Social Development
NGOs	0.11	0.34	0.26	0.56
	0.50	0.66	1.00	0.60
Private	0.19	0.34	0.09	0.09
	0.48	0.31	0.00	0.40
Public	0.70	0.32	0.65	0.35
	0.02	0.02	0.00	0.00

explains why NGOs are focusing more on software components than on hardware components; for the sustainability of WatSan services, software components are more important than hardware components.

The HR shortages for different types of organizations are summarized in Table 14, which shows that, in order to achieve the WatSan MDGs in Tanzania for the water supply sector, more WatSan engineers (2,705) are required in the public sector than in NGOs and the public sector. The biggest shortage in the public sector is for WatSan engineers. This is probably due to the fact that the interest for the public sector is in installing water facilities/infrastructure and that the public sector needs more engineers. Fewer WatSan engineers for the water supply sector will be required in NGOs (425). However, for the sanitation sector, more WatSan and social development professionals will be required in NGOs than in the private and public sectors. This can be explained by the role played by NGOs in changing behaviour as far as sanitation is concerned. For the same sector (sanitation) the HR shortage for NGOs is 319 WatSan engineers and 1,602 social development professionals. The corresponding HR shortages for the private and public sectors are 1,068 and 0, respectively. It still appears that, for the sanitation sector, the public sector does not need more social development, as the public sector's focus is on infrastructure. The results show the importance of NGOs in the sanitation sector but also the need within that sector to focus on the software component.

5. Conclusion and recommendations

5.1. Conclusions

From the study, the following conclusions can be made:

1. For water supply, the HR demand for WatSan engineers is highest, with the majority being demanded in rural areas where most of the Tanzanian population lives. The lowest HR demand is for social development professionals, with less demand in urban than in rural areas.
2. More WatSan engineers will be required to achieve MDGs for water supply than for sanitation, but more social development professionals will be needed for the sanitation sector than for the water supply sector.
3. The HR shortage in Tanzania in the water supply sector is highest for O&M and lowest for mobilization. This can probably be attributed to the need for more maintenance of the infrastructure for the sustainability of the services.

Table 14. HR shortages for different types of organizations.

Organization Type	WatSan Engineers	Other Engineers	Management & Finance	Social Development
NGO (WS)	425	203	988	375
Sanitation	319	293	419	1,602
Private (WS)	734	203	342	60
Sanitation	306	138	0	1,068
Public (WS)	2,705	191	2,470	245
Sanitation	13	9	0	0

WS: water supply.

4. For the water supply sector, the highest HR shortage is for WatSan engineers in rural settings. The lowest estimated shortage is for other engineers in urban settings.
5. In order to achieve the MDGs for WatSan in Tanzania for water supply, more WatSan professionals are required in the public sector than in NGOs and the private sector. Fewer WatSan professionals for water supply will be required in the NGOs. However, for the sanitation sector, more WatSan and social development professionals will be required in NGOs than in the private and public sectors.

5.2. Recommendations

Based on the information analyzed and from information provided by key informants, the following recommendations are made:

1. Increase support for training institutions. There is a pressing need to improve standards of teaching and training through curriculum review and additional funding to expand targeted institutions training WASH professionals at all levels, as part of continuing education for WASH professionals. Additional funding is needed for universities, colleges and other training institutions to enable them to upgrade the quality of their educational activities.
2. Focus on skills required for asset management and O&M. The MDG targets have provided the political incentive to invest in new facilities but more attention is needed to improve skills for O&M.
3. Short-term courses and on-the-job training – There is a specific need for a more strategic and structured approach for the organization and delivery of short-term courses, which need to be better established within existing training institutions, with, for example, a unit dealing specifically with such courses.
4. Impart knowledge by allowing consultants and contractors to implement projects as part of on-the-job training. On-the-job vocational training is required, and staff who have received training should be encouraged to share their new knowledge with their peers as part of in-house vocational training. There is also a need for a range of ‘quick win’ training initiatives to develop essential skills and competences in areas that can produce rapid results. In particular, these include community-based sanitation and hygiene promotion activities.
5. Ensure that professionals have a broad skills base. There is a specific need to attract professionals with a broader base of skills (notably social scientists) to work in the WASH sector.
6. Provide ‘quick win’ training. There is also a need for a range of ‘quick win’ training initiatives to develop essential skills and competences in areas that can produce rapid results, particularly community-based sanitation and hygiene promotion.
7. Specific focus on capacity development in small towns and rural areas. Institutions need to ensure that the most qualified individuals are not all centred in the larger cities. Specific attention is required to deploy and retain the workforce to ensure access to and provision of services across the country on an equitable basis. To support this, ways should be found to speed up the decentralization process, with transfer of additional functions – and funds – to local authorities. Building adequate HR capacity for drinking water and sanitation can only be achieved in the context of broader civil service reform policies being in place.
8. Incentives to address rural to urban brain drain. There is a need for an incentive structure to encourage the deployment of staff to rural and remote areas. Performance-related pay and bonuses for exceeding targets could act as strong incentives to improve performance, motivate and retain staff

and to encourage capacity development. These are private sector principles that have been successfully used in public sector service providers, but there is a need for these principles to be adopted more widely.

9. Addressing the gender imbalance. There is a need to understand why there is still a relatively small proportion of women working in the sector. For women to play a more significant role in meeting predicted future demands for WASH sector workers, it is clear that more girls should be encouraged to gain technical qualifications and employers' preferences should be reshaped to ensure that women participate in the labour market on more equal terms.

Acknowledgements

The work reported in this paper was made possible through collaborative efforts with key stakeholders in Tanzania, IWA, CAP-NET and funding from USAID through the CAP-WASH programme. Various stakeholders were contacted through different means (e.g. visits, phone calls or email), and valuable information was obtained from them and forms part of this paper. These stakeholders include CBOs, NGOs, international organizations, research institutions, vocational training institutes, public institutions dealing with WatSan and government line ministries.

References

International Water Association (IWA) (2012). *Meeting the Water and Sanitation MDGs: A Study of Human Resource Requirements in Tanzania. Country Report*. IWA, Den Haag, The Netherlands.

World Health Organization (WHO)/UNICEF (2010). *Joint Monitoring Programme for Water Supply and Sanitation. Estimates on the Use of Water Sources and Sanitation Facilities in Tanzania.* Country Report, WHO, New York.

World Health Organization (2011). *Addendum, World Health Statistics*, WHO Press, Geneva, Switzerland.