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ENSURING AVAILABILITY AND SUSTAINABLE MANAGEMENT
OF WATER AND SANITATION FOR ALL

# Sanitation management and information technology in Za'atari refugee camp, Jordan

*G. Melloni (Italy), L. A. Parpaleix & J. Pająk*

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*As a response to the declining conditions of sanitation infrastructure in Za'atari refugee camp, Jordan, a WASH repair and maintenance programme was launched in 2014 and has been running since. One of the programme's main features is the use of a tailor-made computer database system. This paper describes the Repair and Maintenance programme as it was designed and implemented by the NGO ACTED, shows how the database structure and end-user interface fit the programme's logic, and describes the database operational applications. The overall conclusion is that the database enhances management in terms of performance, efficiency and accountability. The adoption of similar approaches in other WASH and non-WASH programmes is recommended.*

## Introduction and context

### The Syrian crisis in Jordan

Started in 2011, the conflicts inside Syria between the regime and various non-state actors escalated in the following years. As a result, millions of Syrians have fled their home country seeking protection abroad as refugees. To date, above four million Syrians have left their country, most of them to Turkey (above two millions), Lebanon (above one million) and Jordan (635,000). In addition, it is estimated that seven millions are displaced inside Syria.

In Jordan, most Syrian refugees live in host communities in the northern and central governorates. The remaining refugee population has settled in two main camps established by the government of Jordan and managed by humanitarian agencies under the UNHCR umbrella: Azraq camp -established in April 2014 in Zarqa governorate and hosting 30,000 refugees- and Za'atari camp. The Emirati Jordanian camp, King Abdallah Park and Cyber City are minor camps hosting less than 10,000 refugees altogether.

### Za'atari refugee camp

Za'atari camp was established in July 2012 in Mafraq governorate, on a plain about ten kilometres east of Mafraq town. Za'atari population soared in 2013, peaking at above 115,000. Population gradually decreased and stabilised in the following years. The camp now hosts 80,000 refugees, still representing one of the largest refugee or IDP camps worldwide.

In Za'atari camp basic services such as WASH, Health, Shelter, Protection and Education are provided by humanitarian agencies. The camp is subdivided into 12 districts. Especially starting 2014, efforts have been made to increase the involvement of Jordanian national authorities and of refugee communities in camp governance.

### ACTED[1] in Za'atari camp

ACTED's presence in Jordan dates before the refugee crisis. However, ACTED redirected its programming towards refugee emergency response in 2012, with a focus on WASH. As of today, ACTED is one of the main international NGOs in WASH emergency response in Jordan, providing large scale assistance to refugees and to host communities. ACTED is also operational in the other countries affected by the Syrian crisis.

In Za'atari, ACTED is in charge of drinking water supply (done by water trucking so far), camp cleaning and solid waste management in the whole camp, and of hygiene promotion and repair and maintenance of sanitation facilities in seven camp districts. In addition, ACTED is now installing sewer and water supply systems in the camp in coordination with other WASH agencies, in order to enhance quality and sustainability of WASH services. All above programmes are funded by UNICEF.

## The WASH repair and maintenance programme

### Rationale of the programme

Due to the rapid upscale in 2012 and 2013 and due to funding constraints, sanitation infrastructure in Za'atari camp was initially designed and built based on criteria of economy and time-efficiency, with little or no community consultation. Humanitarian agencies opted for communal "WASH blocks" comprising toilet cubicles, shower cubicles and multipurpose water points and sinks. Each WASH block is equipped with storage tanks for drinking water supply by trucking. Wastewater is collected in cesspits and evacuated by vacuum trucks.

Such setup didn't meet most refugees' expectations though. In particular, cultural factors emerged as a major concern since refugees strongly preferred household-level sanitation over communal facilities. As a result, the practice of cannibalising WASH blocks and building rudimentary sanitation facilities at the household level became prevalent among refugees throughout the camp. By late 2013, the vast majority of refugee households had their own makeshift bathrooms at home, resulting in largely uncontrolled wastewater management and in more and more non-functioning communal WASH blocks.

As one of the measures to deal with the situation, UNICEF (the WASH lead agency in the camp) promoted the establishment of a stand-alone programme of repair and maintenance of WASH blocks to be inaugurated in 2014, aiming to ensure fully functional public sanitation facilities and possibly to discourage the resort to makeshift sanitation facilities at the household level. The overarching idea was that the three agencies implementing WASH in the camp (ACTED, JEN and Oxfam) would take care of ordinary maintenance engaging with the refugee communities, while one agency only (ACTED) would be in charge of providing heavy machinery services to the other agencies for major repairs throughout the camp.

### Description of the programme

ACTED WASH Repair and Maintenance programme (R&M) field operations started in April 2014 and are still running as of 2016. Operations start-up was preceded by extensive community mobilisation, mainly revolving around a WASH Committee system that WASH agencies established in the camp between 2013 and 2014. WASH Committees are groups of refugees residing in Za'atari camp in charge of WASH block cleaning and security and of their upkeep through minor repairs.

ACTED R&M team is in charge of regular maintenance and of medium and large scale repairs of WASH blocks and public water points as well as of water tank disinfection in half of the camp districts. Additionally, the R&M team provides to the other WASH agencies heavy machinery services needed to carry out major WASH repairs in the camp. The core of the R&M program staff is represented by six district managers, each one in charge of overall implementation and proper documentation of the works in the camp district in his/her responsibility. Each district manager supervises one site technician who in turn supervises a team of refugees and ensures the technical quality of the works. Refugee teams are remunerated through a Cash for Work scheme applying daily rates agreed at interagency level in the camp. A data entry unit consisting of Jordanian and refugee staff is in charge of data entry, data processing and reporting. Finally, a dedicated logistics unit made up of a logistics officer, a warehouse manager and a store keeper supports the R&M operations. A programme manager and a project manager ensure overall coordination, planning and supervision. Altogether, the R&M programme employs 16 staff and involves 50 to 60 refugees through the Cash for Work scheme. Some of the 16 R&M staff are also involved in other infrastructure programmes, namely sewerage installation.

All the 175 WASH blocks in the camp districts under ACTED's direct responsibility have been repaired and kept within agreed minimum standards since the third quarter of 2014, whilst the number was close to zero when the R&M programme started. Approximately 40,000 camp residents benefit from the R&M programme in ACTED districts, and the whole camp population benefits from the support the programme gives to the other WASH agencies through provision of heavy machinery. As of 31st December 2015, the WASH R&M programme had been operational for twenty months and had completed above 7,000 repair and maintenance interventions.

*Type of repairs*

In accord with UNICEF and with the other WASH agencies in Za'atari, R&M interventions are subdivided into three main categories.

Tier 1 includes the simplest repairs, such as fixing or replacing leaking taps, which are taken care of by the WASH committees. Tier 2 comprises all repairs exceeding the capacities of the WASH committees but not requiring heavy machinery, and are carried out by the WASH agencies. Tier 3 interventions are the most advanced - e.g. sewage holding tank or sewer line replacements or repairs. They require heavy machinery and are implemented by the WASH agency in charge of that camp area with the support of ACTED-provided heavy machinery.

Overall, most interventions fall under Tier 2. They are predominantly related to water pipe fixing. A relatively high proportion also includes water tank fixing, metal welding (water towers, roofing, doors, hinges and bolt locks, covers of household-level 'makeshift' wastewater pits, etc.), and sewer-related works (sewage holding tanks, sewer lines). In Tier 3, most interventions concern wastewater infrastructure such as sewer line repairs, septic tank repairs, and especially backfilling the widespread household-level 'makeshift' wastewater pits. Additionally, heavy machinery is used in emergency situations (e.g. flooding and winter snow storms) and in WASH construction projects at camp level.

*The R&M process*

In order to ensure transparency and to prevent misuse of materials, tools and consumables, in the inception phase of the R&M programme ACTED put special focus on designing a clear-cut process regulating the programme. As described in full in the sections below, the main tool around which such process revolves is a database.

Each individual repair starts with a repair request or "call" which gets registered in the R&M database. A repair request can be done by any WASH block user through a dedicated phone hotline, through WASH Committees or by directly addressing ACTED R&M field staff. Every repair request gets registered. It will either be followed up upon if it falls within the scope of the R&M programme, or be cancelled and rerouted if it is unrelated to the programme.

Each valid request includes detailed location data and is consequently dispatched to the relevant R&M team member. R&M field staffs assess each valid request and estimate the required tools and materials to carry out the repair. A database operator enters the data from such field assessments in the database, and stock exit/reception forms are automatically generated on that basis. A storekeeper provides the requested tools and materials, recording all stock movements in line with the organisation's operating procedures. Once that is done, teams of Cash-for-Work refugees carry out the repairs under the supervision of R&M qualified field staff. Refugee labour are partly skilled (plumbers, masons, welders, etc) and partly unskilled. A worksheet is filled, and completed works are handed over to the R&M field staff and ultimately to the relevant WASH Committee. Finally, a handover form is filled and the database operator closes the file.

## The database system

### Why a database

In the inception phase of the R&M programme, ACTED analysed the main programme requirements. The main considerations emerging from the exercise were that the programme was substantially a process-based one as shown in the section above; that a close interplay of various actors and departments was essential (refugees, programme department, procurement department, other WASH agencies, etc); and that keeping control over each step in the process would be a key factor to ensure efficacy and accountability at all stages.

Consequently, a tailor-made database was deemed an indispensable management tool. Indeed, the database was designed to represent the programme's core, allowing centralised access to all information, follow-up on all actions, authorisations and approvals, progress tracking and identification of any blockages or irregularities. ACTED designed the database in the first three months of 2014 by using in-house expertise, after consultations with UNICEF and with the other agencies implementing WASH in Za'atari camp.

### Database technical structure

The database technical structure development followed a four-stage process: choice of database management system; database logical structure; database security; and training and refining. However, clear specifications were agreed in a synergy between the programme, logistics, monitoring and evaluation and audit departments before launching the computer-based work. That clarified the programme process

and consequently the expected database requirements. At such an early stage, fundamental choices were done on the basis both of the main process and of the amount of data to be recorded. Any change in those requirements at a later stage would have entailed restarting database development, therefore special attention was devoted to this upstream work.

### Choice of a database management system
A database management system (DBMS) is software for creating and managing databases. It serves as an interface between the database and the end-users. Several DBMS exist with various specifications such as the number of possible concurrent users, table sizes, graphical user interfaces and software development tools.

Microsoft Access was selected for the R&M programme for two reasons specific to the kind of performance required and to the context of use. Firstly, Microsoft Access gathers appropriate technical specifications including a maximum size of two gigabytes, concurrent users, security features and user-friendly interface. Secondly, it is suitable software to set up if basic expertise in computer programming is available but not database specialism. Microsoft Access enables programmers with a systematic way to create and manage data as well as with predesigned customisable user-friendly interfaces for any authorised end-user to update data. Besides, all computers featuring the Microsoft Office package run Microsoft Access, and datasets can be exported as Excel sheets for further analysis with no need to master computer programming or to install third-party software.

### Database logical structure
Three toolsets constitute the database structure. First, tables are the under-structure of the database so their structure has to be designed first and with utmost care. Tables contain all datasets. Secondly, relationships, queries, VBA macros (Visual Basic for Applications) and modules help structuring tables and organising the interaction between tables and end-users. Finally, forms and reports represent the end-user interface, with no need for end-users to be aware of the complexity of the underlying structure. Forms and reports can be refined according to end-users' needs.

The main challenge in developing any database is to set up tables and their relationships to be able to record all needed data and to access them easily. The key element in the R&M programme is the repair stage, where each repair is handled separately and has to be tracked from start to end, as described above in this paper. That is why the "Repair" table was set as the central one in the database. It records all data related to each repair. The Repair table is linked to two other core tables tracking repair requests and the tools and materials used in each repair.

After creating the main tables and their relationships, forms and reports were created. As they constitute the interface that end-users need to understand and utilise, it was of utmost importance to consult with the end-users during database development and to build a control panel that responded to their wishes. Users' specifications helped the programmer to build a first draft which was then refined. The logical flow of the R&M programme was reflected in the database as: notification, assessment, stock request, repair and handover. Each of those steps is matched with one form. Once a step is completed, the form is locked and special authorisation is needed to go backwards in the process. Besides, date and name of anyone modifying these data afterwards are automatically recorded in the database.

### Security
The penultimate step dealt with security. For transparency, accountability and privacy reasons, various complementary security features were included. The front-end file (i.e. the end-user interface) was set to be stored in specific computers and not to be accessed from the cloud. A log-in blocks the access to the application. Each user has to be registered in advance and is provided with a specific authorisation level according to his/her role. For example, a data entry operator won't be allowed to submit a stock request to the warehouse until upper level authorisations are obtained. Similarly, the entire database technical structure is locked by a password. Modifying the database technical structure requires passwords, computer programming skills and exclusive access to the database file, therefore it would be very unlikely to go unnoticed. As additional data security measures, backups of back-end files (i.e. tables recording data on repairs) need to be done on a regular basis and to be saved on removable media stored off-site.

### Training and refining
Training end-users and simultaneously refining the technical structure was the last step in the development of the R&M database. That was done through scenario-based simulations, training sessions

and field tests. Finally the programmer redacted user manuals for each different user level, in order to avoid any knowledge losses (specifically for passwords or one-off tasks) and to help new users to learn how to use the tool.

**Applications of the database**

The R&M database has been operational since April 2014 and has been used in above 7,000 repairs so far. One of the most significant features of the R&M database is the wide range of reporting and data filtering options. In case of any ad-hoc reporting request or if comparing and analysing R&M activities is needed, the database allows extracting detailed records about any repairs through simple search operations. Data can be extracted based on filtering categories such as: period of time; work type; materials used; location; person/s in charge. Since the database records the location, date and type of each repair, it allows identifying issues or anomalies arising in specific cases. For instance, ACTED analysed the R&M data on sewer blockages, locations and frequency and identified areas with recurring problems. Field inspections revealed various unauthorised sewer connections from household toilets. The problem was solved by adding manholes to the main sewer line to which household sewers got properly connected.

The Excel export feature, in addition to allowing in-depth data analysis, allows sharing data with internal or external stakeholders who do not have access to the database, such as various departments in the organisation, beneficiary groups, other agencies, donors and interagency working groups.

Furthermore, the R&M database enhances stock movement monitoring. The estimate of the tools and materials needed in a repair –shown in the assessment form- can be compared to the tools and materials actually used in that repair – shown in the worksheet and handover forms. Detailed records of the materials and tools used in each repair can also be crosschecked with stock movement records. This is crucial in large-scale complex operations like the R&M programme, where above 500 different warehouse items are regularly used and the risk of irregularities in dealing with hardware needs to be carefully kept under control.

Finally, the sheer scale of the R&M operations suggests that efficient and transparent programme management would be hard to achieve without using a solid tailor-made database system. As mentioned above, 7,000 repairs were recorded in the twenty months from the R&M programme start to the end of 2015. This implies that, due to the nature of the process, above 500,000 entries were done in that timeframe – including but not limited to assessments, dates, locations, people in charge, materials, units, handovers. Since the sequence of the entries and the shape and authorisation levels of the forms are set in the database structure and are not manually designed or generated, little room is left for the human error. By doing so - and by making hard to alter the process for unjustified purposes- the database system allows keeping all data accessible, consolidated and safe.

**Conclusions and recommendations**

Using a solid and tailor-made database system of the kind described in this paper presents various benefits:
- Real-time monitoring of ongoing repairs status due to database accessibility;
- Access to consolidated data history to identify trends and adjust operations if required;
- Minimised human error and increased data accuracy thanks to predefined data entry structure;
- Efficient daily processes thanks to automated report filling and to limited time spent on paperwork;
- Cost saving by enhancing accurate use of key resources: materials, tools, consumables;
- Value for money through reduced data entry staff costs;
- Constant accessibility of up-to-date data for monitoring, evaluation, audit and compliance purposes;
- Readiness of data for any regular or ad-hoc reporting;
- Minimised fraud risk through automated authorisation levels and data recording;
- Safety of data thanks to storage in a resilient centralised database;
- Use of commonly available software and of relatively accessible computer programming expertise;
- Overall increased accountability internally, to beneficiaries, to donors, and to any other stakeholders.

As a result, it can be concluded that the use of a solid and tailor-made database as the core management tool of the R&M programme in Za'atari camp has given clearly positive results by enhancing performance, efficiency and accountability.

Taking stock of these lessons, it is advised that adopting similar approaches would be beneficial to WASH and non-WASH humanitarian or development programmes. Due to its nature, such approach seems

particularly suitable for process-based or iterative programmes, where standardised actions happen in sequences in time. Likewise, such approach would be helpful in any programmes recording, processing or storing large amounts of data.

Therefore it is recommended that WASH and non-WASH humanitarian or development agencies embed resources for suitable information technology solutions in programme design and implementation. The type of technology and of expertise required to design and utilise a database like the one described in this paper make this approach likely to be achievable in most countries and organisations, either through in-house expertise or through targeted investment in external expertise and in capacity development.

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**Note**
[1] The views the authors express do not necessarily represent ACTED's views or the view of any of the agencies mentioned in this paper.

**Contact details**
*About the authors: Gian Melloni is a WASH and humanitarian specialist with a background in various Middle Eastern and Sub-Saharan countries, currently employed at Concern Worldwide in the DRC WASH Consortium (Democratic Republic of the Congo). Laure-Anne Parpaleix is an engineer specialised in engineering design and innovation management currently completing a PhD in management science at MINES ParisTech university. Jakub Pająk is WASH infrastructure and repair and maintenance programme manager since early 2014 at ACTED Jordan, responding to the Syrian crisis.*

| Gian Melloni | Laure-Anne Parpaleix | Jakub Pająk |
|---|---|---|
| Email: mail_gmm@yahoo.it; programme@consortiumwashrdc.net | Email: la.parpaleix@gmail.com | Email: jakub.pajak@acted.org; daalej@gmail.com |