UNICEF Iraq

Evaluation of the WASH Smart City Initiative Pilot Project in Baghdad

FINAL EVALUATION REPORT

September 2021

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List of Acronyms

BWD	Baghdad Water Department
EU	European Union
GOI	Government of Iraq
ISIL	Islamic State of Iraq and the Levant
ICO	Iraq Country Office
IPSM-II	Iraq Public Sector Modernization Project – Phase II
IQD	Iraqi dinar
KII	Key informant interview
MOB	Mayoralty of Baghdad
MOCHPM	Ministry of Construction, Housing and Public Municipalities
SCI	Smart City/Cities Initiative
TL	Team Leader
TOC	Theory of Change
UAW	Unaccounted for Water

Executive Summary

Introduction and background

This report presents the findings of the **Evaluation of the WASH Smart City Initiative Pilot Project in Baghdad**. The evaluation started in December 2020 and ended in July 2021. Due to COVID-19 restrictions, data collection ran over eight weeks, though not continuously, from February 21 to April 15, 2021.

The Pilot was implemented under the Smart City Initiative (SCI), which in turn operated under the umbrella of the Iraq Public Sector Modernization Project - Phase II (IPSM-II) from 2013-19. According to the evaluation Terms of Reference (TOR): '*The initiative promotes improved national capacity for water conservation and management, combined with enhanced public access to water monitoring and online billing, through e-Governance under joint initiatives as part of the Iraq Public Sector Modernization Project Phase II (IPSM-II). The Smart City Initiative in Iraq aims to improve capacity for water conservation, improve water management and enhance public access to water*.' The TOR also state that '*the overarching goal [of the SCI] is to reduce water consumption levels, improve network management and reduce wastages and illegal connections*…'

The main activities planned or implemented under the SCI have included the following: 1) *A national public awareness campaign on water conservation (2014-16).* Some further work on water conservation apparently continued beyond this period, with more planned up to 2024; 2) *Establishment of an online billing and complaints system for Baghdad (2016 onwards; ongoing).* The system did not operate over the course of the Al Mansour pilot and roll-out is still pending, though an operational manual was produced in 2019; 3) *Introduction of smart water meters on a pilot basis in Baghdad and Kirkuk (2017-18).* The pilot in Al Mansour, Baghdad, is the focus of this evaluation; 4) *Work on water safety planning and water quality management (start date unclear; ongoing).* This has included the production of a Water Safety Plan for Baghdad and work is underway to upload water quality data produced by the Ministry of Health to the water service provider's website, so that the information is accessible to customers in Baghdad.

The SCI-Pilot in Baghdad (hereinafter referred also as the Pilot) was underway by the fourth quarter of 2017 and comprised the following:

1. UNICEF partnered with Baghdad Water Department (BWD), who selected Al Mansour quarter, a high-income neighbourhood, as the location for the pilot. The water supply service to this area was relatively reliable, though some local network repairs were completed prior to meter installation. Before the pilot, nearly all households had conventional water meters.

2. UNICEF appointed a private contractor to install 149 meters, mostly in private homes, though a small number went to commercial or institutional premises.

3. The meters were not networked, hence remote monitoring of water consumption was not possible. Meters could only be read by visiting each property, though Bluetooth connectivity enabled readings to be taken without going inside (in most cases).

4. UNICEF provided training for BWD personnel in use of the smart meters. Thereafter, ownership of the meters, and responsibility for their maintenance, lay with BWD. UNICEF's substantive involvement in the pilot ended in late 2018 after some technical snags with the installations were resolved.

5. The smart meters were read once every six months, which is the normal interval in Baghdad. Readings were downloaded onto a tablet and later entered manually into the BWD billing system. When visiting a property, the meter reader would also issue a bill for the previous six-month period and collect payment in cash; again, this was the established practice.

Evaluation purpose, objectives and scope

The purpose of the evaluation was 'to independently examine the extent to which the SCI has improved water management, having better data to monitor water wastage and provision in Baghdad city. This analysis will then inform efforts to replicate the smart water initiative across Iraq and UNICEF's efforts to contribute to SDGs 6.1, 6.3 and 6.4.' The Terms of Reference (TOR) also stated that UNICEF had plans to scale the SCI in the short-term, so the evaluation findings would inform related decisions. The specific objectives (as modified during inception) were to: i) Assess the extent to which the smart city initiative has improved water management and provision in Baghdad city by documenting the initiative's achievements and limitations; ii) Assess the capacity

of the consumers and key stakeholders to sustain the smart water meters installations; iii) Provide evidence of the intervention's successes and failures in terms of technical, financial and managerial practices in order to facilitate future planning of such projects; iv) Examine the scalability of the intervention.

Methodology and approach

Evaluation questions covered the thematic areas of Relevance, Effectiveness, Efficiency, Impact, Sustainability, Synergies, and Gender. They were used to develop an evaluation matrix which set out the questions and related sub-questions and explained how the evaluation team would answer them in terms of key informants and methodology. As envisaged in the TOR, the main elements of the methodology were: a review of documents; key informant interviews; and a survey of households which received smart meters under the SCI-Pilot in Baghdad.

Limitations of the evaluation

Due to the COVID-19 pandemic, the evaluation Team Leader was unable to travel to Iraq and even national team members had to carry out some interviews via telephone or email, though it was possible to complete the household survey. The imposition of a daytime curfew from Thursday to Sunday, reducing to four days per week the time potentially available for in-person meetings and survey work, further complicated the data collection. To mitigate this situation, the evaluation mission was extended and eventually lasted for nearly eight weeks. The number of key informants identified was also very small and it proved difficult to secure appointments with them. Although a relevant number of documents was shared by UNICEF, no standard design or project document was available, very little documentation was available on the content of the Pilot, and no results data were produced.

The effect of these limitations was that, despite extending the data collection period, it was very difficult to explore the evaluation questions in as much depth as would have been the case with good access to information and people and with the whole team in-country.

Findings

Relevance

SCI objectives and activities are relevant to the water supply needs of BWD and other water service providers, and potentially to consumers. However, the anticipated benefits are yet to be achieved.

As lead external support agency for the water sector, UNICEF is in a privileged position to advocate for, and provide strategic guidance to, initiatives to improve urban water supply services within and beyond Baghdad. The SCI represents a good fit with this role. It is doubtful, however, that UNICEF has comparative advantage in terms of in-house capacity and resources to support city-wide water supply improvements directly.

Effectiveness

Up to now, the anticipated benefits of the SCI are more aspirations than achievements. Evidence from the service provider and households indicates that the SCI-Pilot in Baghdad has not led to reduced water consumption or improved network management; while implementation of the online billing and complaints system developed with UNICEF support is still pending, despite the work towards its roll-out is going on**.** The inability to monitor water consumption remotely was a significant limitation of the pilot, hence easy detection of leaks or unauthorised consumption was not possible. The household survey also found that having smart meters made very little difference from the consumers' point of view. Meters were read once every six months, as they had been before the pilot, and BWD meter readers continued to issue bills and collect payment in cash when making their visits. Monitoring of the pilot was inadequate. By not adopting indicators of success and monitoring progress towards their achievement, opportunities were missed for learning lessons to inform the future use of smart meters within or beyond Baghdad.

Efficiency

In the absence of information on project budget and expenditure data, it is very difficult to assess cost-efficiency, and the evaluation found no evidence that this has ever been attempted. No dedicated team or institutional structure was set up to spearhead the initiative; activities were managed alongside other components of the country WASH programme. This is normal for UNICEF WASH programming globally, and for the smart meters

pilot seems reasonable as it was a small operation. Even if it had been monitored more effectively, it would probably not have needed any full-time personnel, whether staff or consultants.

Impact

The SCI is appreciated by senior officials responsible for urban water supply, both in the Mayoralty of Baghdad and the Ministry of Construction, Housing and Public Municipalities (MOCHPM), which is responsible for urban water supply in other cities. They recognise the need to modernise and improve service provision and MOCHPM is now planning to extend the introduction of smart meters to three governorates using private finance. However, the application of charges based on actual water consumption has not yet been introduced in these governorates. MOCHPM plans are predicated on securing legislative changes so that volumetric tariffs can be introduced; a tariff reform bill was drafted in 2014 but its enactment is pending. Respondents noted that the political will to make water services financially self-sustaining is currently weak. Per capita water consumption in Baghdad is exceptionally high by global comparisons and tariffs are very low. Equity concerns relating to water supply are therefore not obvious, though reduced average consumption might improve access for those living on the outskirts of the city. The SCI-Pilot in Baghdad did not reduce consumption in targeted high-income households, however, and it is difficult to see how smart meters on their own could have any impact on equity of access to water.

Sustainability

UNICEF provided technical training for service provider personnel in the use of smart meters. Those installed in Al Mansour remain mostly functional, though there are some isolated problems with Bluetooth connectivity. Capacity building in network maintenance, however, was beyond the scope of the SCI-Pilot in Baghdad. While it would be possible to install smart meters in other cities, there would be little point in doing so while billing is based on property size and garden area rather than actual water consumption. Even if changes in policy and legislation allowed volumetric tariffs to be introduced, the benefits of installing smart meters rather than conventional ones would be very limited unless smart grids were also established.

Synergies

No dedicated co-ordination platform was set up to monitor the SCI-Pilot in Baghdad or the SCI overall, but the Pilot involved very few institutional stakeholders, hence the co-ordination needs were modest. Beyond the pilot, some other activities under the SCI umbrella had their own co-ordination arrangements.

Gender

There was no explicit gender dimension to the design or monitoring of the SCI. Given the narrow technical focus of the pilot and the unusual context of excessive water consumption city-wide, the gender-related aspects of the Al Mansour pilot, and the SCI overall, are not obvious and the evaluation found no evidence of any substantive gender-related challenges being neglected. Some respondents nevertheless highlighted two gender-related benefits of the pilot: i) the training UNICEF provided in the use and maintenance of smart meters included a significant number of female personnel from the service providers, ii) the pilot provided a security benefit to women and girls in the since meter readings could now be taken without entering a property.

Conclusions

The SCI-Pilot in Baghdad and the SCI overall have not, so far, achieved the objectives of reduced water consumption and improved network management. The ambitions of the Pilot were clearly unrealistic given that smart meters were installed without the capacity for remote, real-time monitoring or links to an online billing system; and in an environment where tariffs that were too low to incentivise households to moderate their consumption. In Kirkuk, volumetric water charges were not permitted at all under the prevailing policy and regulatory framework, which further reduced the value of the Pilot, and it is unclear whether or when this arrangement will change.

The Pilot was more successful in introducing smart meter technology and its potential benefits to service providers and other government partners within and beyond Baghdad. Beyond the Pilot, the online billing and complaints system developed with UNICEF support has not been implemented by BWD up to now, but the groundwork undertaken has provided a foundation that can potentially be built on by BWD.

The results of the Pilot are not surprising but would have come to light much sooner had the project been monitored.

UNICEF is in a privileged position to advocate for and provide strategic guidance to initiatives to improve urban water supply services within and beyond Baghdad. It is however doubtful that the UNICEF Country Office would have the in-house human and financial resources to directly support water supply improvements.

Recommendations

Draft recommendations were shared with the Evaluation Steering Committee in the evaluation de-briefing meeting, and feedback from that meeting informed the composition of final recommendations as set out below. The last point is offered as "food for thought", as it concerns smart metering in general, not the specific project under review

1. Repeating the installation of smart meters on a stand-alone basis, and in locations where volumetric charges are not permitted, should be avoided. Instead, UNICEF should encourage (and potentially support, if funds are available) the demonstration of full smart functionality, as described in the evaluation TOR (i.e. installing and testing a networked smart water grids that automate water monitoring and control), ideally by building on the SCI-Pilot in Baghdad.
   Responsible Actor: UNICEF

2. When planning future activities under the SCI, UNICEF should set objectives that are realistic in terms of what IT improvements can deliver on their own.
   Responsible Actor: UNICEF

3. UNICEF (and other development partners) should continue to advocate for implementation of the reforms envisaged in the 2011 Road Map. The need for an updating of the Road Map should be further explored by UNICEF.
   Responsible Actor: UNICEF

4. For any future project, including a pilot, UNICEF should set out the purpose, objectives and expected results in a project document and results framework that explain clearly the rationale for the pilot including the particular issue or challenge it is trying to address and how this will (potentially) be achieved.
   Responsible Actor: UNICEF

5. Thereafter**,** UNICEF and their implementing partners should monitor any future project, including a pilot, closely to track what changes are achieved against the project document, the results framework and, if available, a documented baseline.
   Responsible Actor: UNICEF

- In the longer term, should tariff reform be introduced along with strong incentives to make services financially sustainable, there could be value in exploring how smart meters can play a more targeted role in ensuring access to sufficient water for the urban poor.

1 Introduction

This report presents the findings of the evaluation of the WASH Smart City Initiative Pilot Project in Baghdad (hereinafter referred also as the Pilot), which was implemented via a partnership between UNICEF and the Mayoralty of Baghdad (MOB).

The evaluation started in December 2020 and ended in July 2021. Restrictions related to the COVID-19 pandemic meant that much of the data collection had to be conducted remotely and took longer than planned. In the event, data collection ran over eight weeks, though not continuously, from February 21 to April 15, 2021.

1.1 Background

UNICEF WASH programming in Iraq

In recent years, the UNICEF Iraq Country Office (ICO) has been helping the Government of Iraq begin the process of transition from a protracted humanitarian crisis to longer-term development planning, with a focus on strengthening public institutions and improving basic services. For the UNICEF WASH section, this has meant supplementing their humanitarian work with capacity building and infrastructure updating initiatives for the key institutions responsible for water supply, sanitation and water resources management.

UNICEF is formally designated as the lead external agency supporting the Government of Iraq (GOI) in WASH, and much of its development-oriented work in recent years has been under the umbrella of the EU-funded Iraq Public Sector Modernization Project, Phase II (IPSM-II), a multi-agency initiative which operated from 2013-19. UNICEF and UN-Habitat worked in co-operation with other UN agencies to implement the project.

The transition from emergencies to development has not been smooth and the single biggest challenge during IPSM-II came in mid-2014 when substantial territory across four governorates was taken over by ISIL. This deterioration in security led UNICEF to pause its development work and focus on immediate humanitarian needs. The crisis lasted for more than three years, though IPSM-II activities were eventually able to resume[1].

Urban water supply

As part of the groundwork for public sector reforms undertaken during IPSM-I, two keynote studies[2] were produced in 2011 reviewing the current status of the WASH sector in terms of the services available and the policy and institutional environment within which they operated. The weaknesses identified in these studies are cited in several UNICEF plans and reports issued over the period and include the following:

1. An extremely low water tariff, with revenue totally inadequate to cover operation and maintenance costs. Terms of Reference (TOR) for the evaluation note that in Baghdad, 90% of household water meters are non-functional. As a result, most users are billed on a flat-rate basis, irrespective of how much water they consume. In short, consumers have no incentive to moderate their water consumption, whether or not they have a functioning meter.
2. Exceptionally high per capita water consumption, as a consequence of the above. The TOR cite this at 327 litres per capita per day, more than double the average in EU countries; some other sources quote an even higher figure.
3. Poor water quality.
4. Ageing and defective infrastructure.
5. A high level of unaccounted for water (UAW), with system losses estimated at 50%.
6. Inefficient management including poor operation and maintenance practices.
7. Lack of public awareness of the need to moderate domestic water consumption.

A 'Road Map to Modernization, Water and Sanitation Sector' was published in 2011, building on the findings of the studies. This envisaged sector reform including adoption of a 'Corporatization Model' whereby a government-owned corporation would hire private sector management to operate and maintain water and

[1] UNICEF (2017). Public Awareness Creation on Efficient Water Use and Improved Hygiene Practices in Iraq. Final Report to European Commission.

[2] UNICEF/UN-Habitat (2011) Iraq- Public Sector Modernization Program, Functional Review report, Water and Sanitation Sector; UNICEF/UN-Habitat (2011) Iraq- Public Sector Modernization Program, Service Delivery Report, Water and Sanitation Sector. Note that the country programme documents we refer to in the document review are dated from 2016 onwards, sometime after the SCI emerged. The Team paid more attention to IPSM-II, which started earlier and provided the overarching framework for the SCI.

sanitation services in a specific region, subject to rules and standards imposed by a separate Regulatory Commission.

The Road Map provided strategic direction to the water sector component of IPSM-II from 2013 onwards, but progress was slow and today many challenges remain. For example, there is so far no independent regulator and substantive private sector participation in service delivery is yet to be introduced. In Baghdad, water supply in the main part of the city continues to be provided by Baghdad Water Department (BWD), which operates under MOB. BWD relies almost entirely on MOB for operating subsidies since revenue generation is extremely low. For greater Baghdad and other cities in Iraq, responsibility for urban water supply lies with The Ministry of Construction, Housing and Public Municipalities (MOCHPM).

1.2 The Smart City Initiative

EU-funded Public Awareness Project

In 2014, UNICEF submitted a proposal to the EU for a project under IPSM-II entitled "Public Awareness Creation on Efficient Water Use and Improved Hygiene Practices in Iraq". The proposed project would complement other initiatives under IPSM-II, some spearheaded by other international development agencies. According to the proposal, the project targeted ten million people - one third of the total population - with messages on water conservation, hygiene and water handling at household level, water harvesting and the importance of water re-use; there would also be pilot projects on 'environmentally sustainable solutions to water supply and consumption'. Four key results were targeted:

Table 1 - Results from Public Awareness project

Result 1:	Public awareness activities on water conservation and hygiene institutionalized and strengthened within the existing government structures.
Result 2:	Nationwide information on water conservation and hygiene practices documented.
Result 3:	Efficiency of water supply systems improved in three pilot project locations.
Result 4:	2 million people in Iraq have better knowledge and attitude on water conservation and hygiene practices.

The relevance of the project to this evaluation arises from Result 3. The proposal and associated final report (dated April 2017) confirm that the three short pilots conducted (in Baghdad, Erbil and Najaf) focussed on water conservation and included the use of water flow monitoring and measuring equipment but do mention smart meters. However, UNICEF WASH Section has confirmed that the smart meters pilot in Baghdad (the focus of this evaluation) was in fact funded under the EU project, even though it began sometime after the final report was submitted.

The Smart City Initiative

The SCI is anchored in the Country Programme Documents and ICO Sector Strategy note. Specifically, the UNICEF Country Programme Document Iraq (2016-2019), clarifies that among five priority 'reinforcing' strategies one is for "strengthening technical and management capacities among service providers for delivery of quality social services, particularly at subnational level". In addition, UNICEF Country Programme Document, Iraq (2020-2024) highlights domestic over-consumption of water from the public network. "A low water tariff, compounded by lack of awareness about water scarcity, has led to a daily per capita consumption that exceeds the international average of 200 liters".

Exactly when UNICEF adopted the Smart City Initiative is not clear from programme documentation, but it appears to have been some time after IPSM-II began in 2013. The lack of clarity arises because the SCI did not have any real project document behind it. In the absence of a project document, the SCI had no defined start or end date or dedicated budget, and in the documentation shared with the evaluators there is no definitive statement as to which UNICEF-supported activities fell within its remit. According to the evaluation TOR:

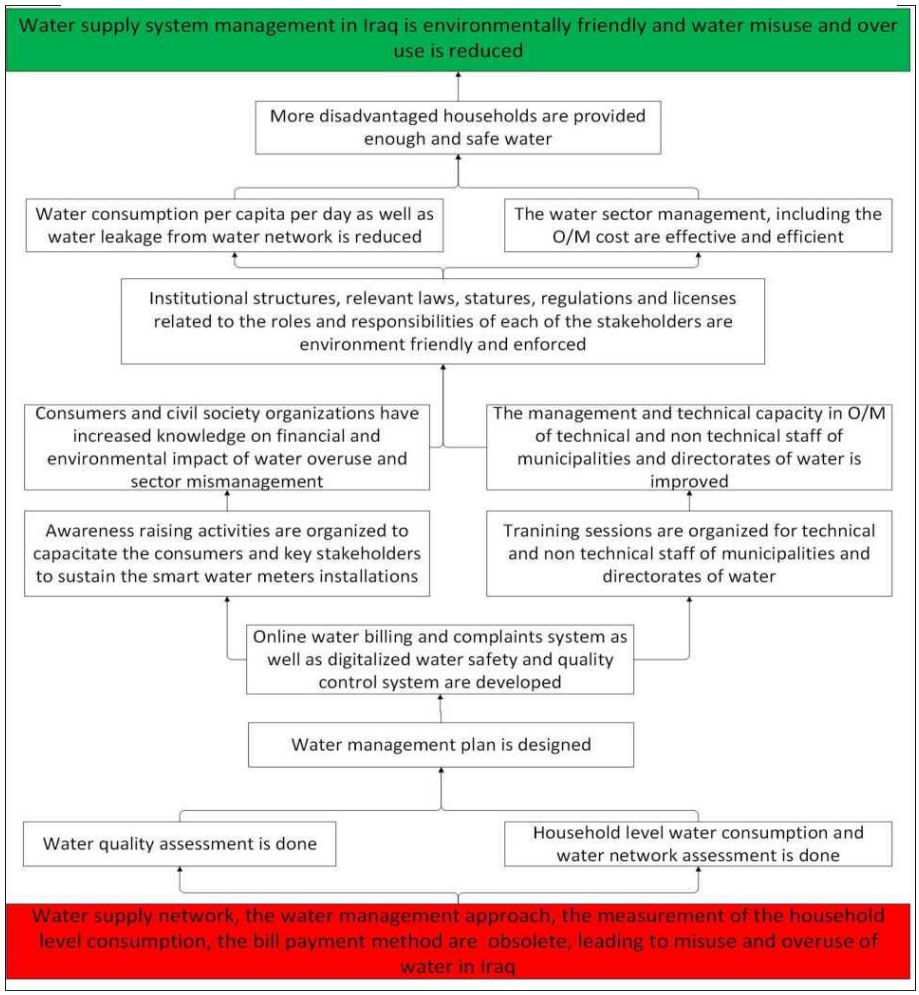
'*The initiative promotes improved national capacity for water conservation and management, combined with enhanced public access to water monitoring and online billing, through e-Governance under joint initiatives as part of the Iraq Public Sector Modernization Project Phase II (IPSM-II). A smart city is one that uses electronically*

collected data to improve efficiency in resource use and service provision. The Smart City Initiative in Iraq aims to improve capacity for water conservation, improve water management and enhance public access to water.'

The TOR also state that *'the overarching goal [of the SCI] is to reduce water consumption levels, improve network management and reduce wastages and illegal connections…*' There is no elaboration on what would constitute improved network management and no associated indicators for this are identified in programme documentation. The evaluation team therefore maintained an open mind as what could meet the requirement and looked for any examples of improvements that were cited by respondents or in documents. Reduced wastage and illegal connections, for example, though listed separately from network management in the quote above, would arguably fall within this category.

While the SCI has no dedicated project document, a Theory of Change (TOC) was developed in 2018 and was appended to the evaluation TOR; see Figure 1. This does not refer specifically to urban water supply; the change envisaged is for Iraq as a whole; it makes no direct reference to the installation of smart meters and what the proposed 'digitalised water safety and quality control systems' would consist of is unclear but suggests something more than just smart meters. The TOC is nevertheless a useful point of reference insofar as it identifies the broad range of interventions contributing to the SCI and confirms that reductions in household water consumption and network leakage are among the higher-order objectives. The TOC lacks an accompanying narrative explaining causal links in the process, however, and does not mention any assumptions on which it is based. The evaluation TOR offer some explanation, saying that: '*….an online water billing and complaints system combined with digitalized water safety and quality control systems will allow consumers… to better monitor their water usage. This… alongside a concerted effort to increase public knowledge about the…. impact of water mismanagement and overuse, should lead consumers to decrease their daily water usage*.'

Figure 1 - Smart City Initiative Theory of Change



Source: Evalutation Terms of Reference

This seems plausible, but in other respects the TOC lacks logic as it suggests that awareness campaigns and better IT systems will lead to positive changes in the institutional and regulatory framework for service provision, which seems highly unlikely. There is also no mention of the role of tariffs in demand management. Furthermore, the sequencing of interventions in the TOC does not reflect what has happened in practice. Progress is predicated on the establishment of an online billing system and digitalized control systems, but the national awareness campaign on water conservation was actually completed some years before development of the billing system or the piloting of smart meters.

It follows from the above considerations that the SCI ToC could not be a viable analytical framework for use in this evaluation. This was further confirmed by interviews with project stakeholders who indicated that the TOC was not an important point of reference for them.

Based on the information available, the evaluators have assumed that the main activities planned or implemented under the SCI have included the following:

1. *National public awareness campaign on water conservation (2014-16).* This was the EU-funded project mentioned above. Some further work on water conservation apparently continued beyond this period, with more planned up to 2024.

2. *Establishment of an online billing and complaints system for Baghdad (started 2016; ongoing).* Software and operational guidelines were developed some time ago but securing adoption and implementation by BWD has proved to be challenging. The system did not operate over the course of the Al Mansour pilot. However, an operational manual was produced in 2019 and UNICEF is working towards the roll-out of the system.

3. *Introduction of smart water meters on a pilot basis in Baghdad and Kirkuk (2017-18).* The pilot in Al Mansour, Baghdad, is the focus of this evaluation. The expectation was that the introduction of smart meters and other technological interventions would enable the service provider to reduce unaccounted for water and manage demand more effectively.

4. *Work on water safety planning and water quality management (start date unclear; ongoing).* This has included the production of a Water Safety Plan for Baghdad and work is underway to upload water quality data produced by the Ministry of Health to the water service provider's website so that the information is accessible to customers in Baghdad.

For the purposes of the evaluation, the WASH Section retrospectively developed a results framework for the SCI; see Table 2. This mentions the smart meter pilots at activity level but identifies no targets, milestones or progress indicators. The indicators associated with the SCI output are pitched at policy level and could not be applied directly to the SCI-Pilot in Baghdad since this focused on the introduction of smart meters on a very small scale in one neighborhood, over a relatively short timescale.

Table 2 - Results Framework relating to the smart meters pilot, as shared by UNICEF WASH Section

Outcome	Output	Indicators	Activities	Verification Sources
By 2019, children and families have improved and equitable access to and use of safe drinking water and sanitation, and improved hygiene behaviours in the most vulnerable communities, schools and health facilities, including in humanitarian situations.	Government has strengthened capacity for water auditing and integrated water resource management and planning.	Number of new policies on water resource management and planning	Development of online water bills service and complaints system	Partners report Programmatic visits and Digital monitoring
		Existence of strategy and guidelines for integrated water resource planning	Pilot projects for improving efficiency and reduction of water losses in the water supply system and at households in selected communities	Partners report Programmatic visits and Digital monitoring

Source: UNICEF Evaluation Manager, personal communication

Since it was produced during the evaluation, this Results Framework did not inform the planning or implementation of the Pilot. Neither did key respondents refer to it during interviews, confirming that it did not have much significance for them. Therefore this Results Framework was not useful for the evaluation beyond

confirming what key UNICEF personnel had said during the interviews, that the Pilot was more of an activity than a project. Similarly, the TOC was not viable as an evaluation tool.

1.3 The SCI Pilot Project in Baghdad

The TOR define the focus of the evaluation as follows: '*the evaluation exercise will cover the smart water meter programming in Baghdad over the last two years (2018-2019). Smart water meter programming has taken place in the Al Mansour quarter, where roughly 250 households and a number of public buildings, schools, and a mosque have received smart meters*.'

The pilot is inserted in the ICO Strategic Notes by the UNICEF WASH team, which – among the others - specify that UNICEF WASH team "will continue to support the Mayoralty of Baghdad and the Ministry of Construction, Housing and Municipalities for scaling up the Smart water management initiative within Baghdad and other governorates in the country".

As with the SCI overall, there was no project document for the Pilot, which operated in both Baghdad and Kirkuk. UNICEF WASH Section has, however, confirmed that a reduction in water consumption and improved network management were two objectives of the Pilot, and also mentioned a third: to introduce smart meter technology to the service provider and generate interest in scaling up its use.

The main stakeholders of the SCI-Pilot in Baghdad were UNICEF Iraq's WASH section, MOCHPM, MOB and the Kirkuk Directorate of Water.

With very little documentation available on the pilot project, information on the activities undertaken was obtained primarily through interviews with UNICEF and service provider personnel. This indicated that the pilot was underway by the fourth quarter of 2017 and comprised the following:

1. UNICEF partnered with BWD and they selected Al Mansour quarter, a high-income neighbourhood, as the location for the Pilot. The water supply service to this area was considered to be relatively reliable, though some local network repairs were completed prior to meter installation. Before the Pilot, all or most households already had conventional water meters, though no baseline data were recorded on the extent to which these were functional.

2. UNICEF appointed a private contractor to install the smart meters. In total, 149 were installed, mostly in private homes, though a small number went to commercial premises or institutional buildings[3].

3. The meters were not networked, hence remote, real-time monitoring of water consumption across the metered location was not possible. Meters could only be read by visiting each property, though Bluetooth connectivity enabled readings to be taken without going inside (in most cases).

4. UNICEF provided training for BWD personnel in use of the smart meters. Thereafter, ownership of the meters, and responsibility for their maintenance, lay with BWD. UNICEF's substantive involvement in the pilot ended in late 2018 after some technical snags with the installations were resolved. There was, however, no official end date.

5. Following installation, the smart meters were read once every six months, which is the normal interval for meter reading and billing in Baghdad. Meter readings were downloaded onto a tablet and later entered manually into the BWD billing system. When visiting the property, the meter reader would also issue a bill for the previous six-month period and collect payment in cash; this was the established practice.

6. The pilot in Kirkuk operated in a very different context, as volumetric charges were not permitted at all. Instead, flat rate charges were applied based on the number of rooms in a property and the garden area.

No progress reports or results data were produced by UNICEF beyond brief written confirmation in late 2017 that the meters were installed and functional. The WASH Section have indicated that limited reporting was done because the Pilot was one of several interventions contributing to the SCI and not a project in its own right. The absence of a project document or results and budget data was a complicating factor for the evaluation, as specified in sub-section 2.2 on Limitations. The implications of this gap are discussed further in section 3.

[3] Note that commercial and institutional buildings were beyond the scope of the evaluation and no primary or secondary data were therefore gathered.

2 Evaluation purpose, objectives and scope

Box 1 presents the evaluation purpose and objectives as defined in the TOR.

Box 1. Evaluation purpose and objectives.

Purpose

The purpose of the evaluation is to independently examine the extent to which the smart city initiative has improved water management, having better data to monitor water wastage and provision in Baghdad city. This analysis will then inform efforts to replicate the smart water initiative across Iraq and UNICEF's efforts to contribute to SDGs 6.1, 6.3 and 6.4.

Objectives

The UNICEF Iraq WASH Section has plans to scale the SMART City initiative in the short-term, so all findings from this evaluation will inform decisions and planning for bringing the initiative to scale.

The specific objectives of the evaluation (as modified during inception) were to:

- Assess the extent to which the smart city initiative has improved water management and provision in Baghdad city by documenting the initiative's achievements and limitations.
- Assess the capacity of the consumers and key stakeholders to sustain the smart water meters installations
- Provide evidence of the intervention's successes and failures in terms of technical, financial and managerial practices in order to facilitate future planning of such projects.
- Examine the scalability of the intervention

Regarding stakeholders, the TOR also indicate that the evaluation will facilitate learning for decision makers looking to design programmes that deliver sustainable results; and enable managers to make revisions to the current programme where necessary.

At the end of the inception phase, a number of modifications to the TOR were agreed with UNICEF, though the TOR were not formally re-issued; see approved inception report[4]. In addition to correcting some basic facts, the revisions included small changes to the evaluation questions, and the amended set is presented in the evaluation matrix; see Annex 2. Other agreed amendments included the following:

1. The fourth evaluation objective originally addressed scalability only in terms of 'relevant legal regulations and stakeholder roles and responsibilities.' Since there could be other factors that affect scalability (for example functionality of the meters and whether they encourage customers to moderate their water use) it was agreed during inception that the evaluation would consider the prospects for scalability more broadly.
2. Within the TOR there was a mismatch between the focus on qualitative questions and use of secondary data; and an expectation that the consultants would conduct technical assessments of the water supply network within and beyond the pilot location. It was agreed with UNICEF that there was in fact no need to undertake anything more than very 'light touch' technical assessments, for example noting whether the distribution network in the pilot location had any obvious defects such as visibly leaking pipes, missing or broken taps etc.
3. The TOR state that 'the evaluation exercise will cover the smart water meter programming in Baghdad over the last two years (2018-2019).' This focus is clear but is contradicted by a later sentence which says that the evaluation 'will look into all components of the smart city project.' It was agreed with UNICEF that the evaluation would focus mostly on the Pilot over the 2017-19 period but would also take into account related SCI work before and during this period, as it was part of the framework within which the Pilot operated.

It is also important to highlight here that during the evaluation inception phase, it came to light that some key information in the TOR concerning the Pilot was inaccurate. In particular:

1. The total number of smart meters installed in Baghdad was 149, not 250, and they were installed in

[4] These modifications were made necessary by the lack of accuracy of the original TOR, which presented several errors and mismatches. Please refer to the IR and the consultant's initial comments to the TOR for more details.

2017, not 2019.

2. The SCI did not create 'networked smart grids that automate water monitoring and control'. Smart meters were installed on a stand-alone basis and could not be read remotely from BWD offices.
3. No online billing and complaints system was introduced before or during the pilot. Instead, manual delivery of bills and collection of cash payments continued as before.
4. The Ptargeted a high-income neighbourhood and as such did not offer any direct benefits to poor or marginalised service users.
5. No customer survey was carried out ahead of the evaluation.

2.1 Methodology and approach

The TOR clustered the 14 evaluation questions under the thematic areas of Relevance, Effectiveness, Efficiency, Impact, Sustainability, Synergies, and Gender. The questions were used to develop an evaluation matrix (see Annex 2) which set out the questions and related sub-questions and explained how the evaluation team would answer them in terms of key informants and methodology.

The agreed methodology was, in principle, quite straightforward. As envisaged in the TOR, the main elements were:

1. **A review of documents**. Most of the documents made available to the team were shared at the start of the inception phase, and a review was included in the inception report. See Annex 6 for the list of documents consulted.

2. **Key informant interviews (KIIs)** and discussions with UNICEF personnel, representatives of government partners and one other development partner active in the WASH sector. See Annex 4 for the list of key informants interviewed. Most of the interviews were conducted by the national team members, under the guidance of the Team Leader who facilitated ad-hoc coaching and team-work sessions. While respondents were interviewed in-person where possible, COVID-19 restrictions meant that some interviews had to be conducted remotely; some respondents also preferred to respond in writing to questions sent by email rather than talking directly. The Team Leader also led a number of calls with the WASH Chief and his team.

3. **A survey of households** which received smart meters under the SCI-Pilot in Baghdad. Further details are provided in Annex 3. Note that it was not viable retrospectively to assess customer opinions relating specifically to the 2018-19 period, so questions simply asked about customer experience and satisfaction since the meters were installed. The Pilot provided smart meters to 149 properties in Al Mansour quarter, nearly all of them domestic. The Team adopted a random sampling and the survey covered 55 households, roughly one third of the total (see Annex 3 for further details). The survey team comprised one male and one female interviewer, and most respondents were older people, many of them female. A BWD meter reader accompanied the team to facilitate introductions but did not participate in the interviews.

The main objectives of the survey were to find out:

1. Whether smart meters have encouraged households to limit their water consumption
2. Whether respondents think that the quality of service has improved over the course of the pilot

At inception it was anticipated that there would, in addition, be some qualitative and quantitative analysis of billing and consumption data for the pilot location. However, the evaluators were unable to access these records; only total consumption data for the pilot properties were made available. A light-touch (mostly visual) assessment of the condition of water supply infrastructure in the pilot area was also conducted. In addition, the survey has been analysed qualitatively rather than quantitatively given the number of answers (55) that only allowed for frequencies distribution but prevented more deep analysis. Useful insights about customer satisfaction were nonetheless provided by the survey.

As far as the analysis is concerned, the Team:

- Summarised and translated key findings from KIIs and other sources
- Translated and analysed the survey responses

- Met remotely to triangulate to the extent possible findings and, on that basis, agreed conclusions and generated recommendations.

In the absence of a design or project document for either the SCI or the Pilotand in consideration of the serious limits affecting both the SCI TOC and the retrospectively developed results framework (as described in the previous sections), the evaluation could not be based on any overarching analytical or conceptual framework.

The evaluation matrix represented the main evaluation analytical tool and, despite the serious difficulties in access to information (see below the section on Limitations), KIIs, FGDs and a review of documents were sufficient to reply to the evaluation questions. In addition, best practices and examples deriving from the ET's previous experience worldwide have also been kept in due consideration along the analysis work.

A de-briefing meeting with UNICEF was organised where draft recommendations were discussed and refined.

2.2 Limitations of the evaluation

The evaluation took place during the COVID-19 pandemic and this imposed severe restrictions on data collection, though it was not the only factor making this an unusual evaluation exercise. The principal constraints were as follows:

a) Remote working

Before the start of the inception phase, it became clear that the UK-based Team Leader (TL) would be unable to visit Iraq due to the pandemic and instead would support and guide two national consultants remotely, while also participating in - and on occasion leading - some online interviews and discussions, primarily with UNICEF staff.

Local pandemic restrictions meant that the national consultants also had to conduct some interviews via telephone or email and travel to Kirkuk, the second pilot project site, was not permitted.

These limitations were mitigated by ongoing, in-depth communication between the Team Leader and the two national team members. Internet connectivity was mostly good enough to enable effective communication within the team. The national team members were assisted by the Team Leader before and during the data collection. Data triangulation occurred to the extent possible both during the data collection and at the end of it. The national team members provided summaries of the interviews to the Team Leader and numerous calls and email exchanges were made to clarify any detail.

It is important to highlight that the partially remote nature of the evaluation did not affect the quality nor the length of interviews and the survey.

b) Access to key informants and data

The imposition of a daytime curfew from Thursday to Sunday, reducing to four days per week the time potentially available for in-person meetings and survey work, further complicated the data collection. To mitigate this situation, the evaluation mission was extended and eventually lasted for nearly eight weeks, though just four weeks were originally planned.

The number of key informants identified by the UNICEF WASH Team was very small – smaller even than was suggested in the TOR. It also proved more difficult than is normal for evaluations of this type to secure appointments with them. It was eventually possible to interview most of them (but not UN-Habitat) and some were interviewed multiple times, thanks to the extension of the mission.

UNICEF shared a large set of documentation, but no standard design or project document was available.

Very little documentation was available on the content of the smart meters pilot. Where the SCI or smart meters pilot were mentioned in UNICEF plans and reports, this was mostly in general terms, citing anticipated achievements or an intention to scale up the use of smart meters, but with no specific information on the results of the pilot – for example, any changes in household water consumption. The evaluation TOR nevertheless made specific claims, including the following:

'*In 2018 alone, more than 650,000 subscribers whose water service provider is the Mayoralty of Baghdad accessed the newly established, public web-based online water billing and complaints system and 16,000 inhabitants of Baghdad and Kirkuk cities reduced their water consumption through early leakage detection*.'

As noted above, the online billing and complaints system was not in fact implemented, though substantial work for its development was done and is still ongoing with UNICEF support. Similarly, in the absence of a 'smart grid'[5] of networked meters, as referenced in the TOR, early leakage detection through remote monitoring was not possible.

The **effect of these limitations** was that, despite extending the data collection period, it was very difficult to explore the evaluation questions in as much depth as would have been the case with good access to information and people and with the whole team in-country. The scope for triangulating data from multiple sources was also limited, though sufficient to validate the findings and conclusions included in this report.

2.3 Ethical Considerations

The Evaluation has been carried out in accordance to from the guidance provided by the United Nations Evaluation Group (UNEG), including: UNEG Ethical Guidelines 2020 and UNEG Code of Conduct for Evaluation in the UN system.[6]

The UNEG ethical standards that guided the evaluation have included the obligations of evaluators (independence, impartiality, credibility, conflicts of interest, accountability), and the ethical safeguards for participants (including confidentiality and avoidance of harm).

The team maintains custody of the data, through agreed procedures for data transfer, storage, de-identification and destruction. Lattanzio adopts appropriate technical and organizational measures to comply with the principles of data protection. Specifically, the company has adopted a **Privacy Management Model** pursuant to EU Regulations, and is implementing a process of adjustment and strengthening of its IT security policies to better guarantee the integrity and availability of the data processed.

All subjects to be interviewed during this evaluation have been offered an **informed consent agreement.** The informed consent forms:

1. Explain the purpose of the study - A statement that the study involves research, an explanation of the purposes of the research, the expected duration of the subject's participation, a description of the procedures to be followed;
2. Explain risks and benefits of the study - A description of any risks or benefits to the subject or to others which may reasonably be expected from the research;
3. Explain the voluntary nature of participation - A statement that participation is voluntary and negotiable, refusal to participate or to not respond to any question will involve no penalty or loss of benefits, and that the subject may discontinue participation at any time without penalty or loss of benefits to which the subject is otherwise entitled;
4. Describe privacy and confidentiality for participation - A statement describing the extent to which privacy and confidentiality of records identifying the subject will be maintained, any limitations to confidentiality (e.g., mandatory reporting of abuse, etc.), and when data will be destroyed;
5. Provide contact information - An explanation of who to contact for answers to questions about the evaluation and subjects' rights, and who to contact in the event of an evaluation-related injury to the subject.

During the field data collection, both the survey and the interviews, the team has collected and stored the IC forms in order to scanned and save them in the Lattanzio's internal terminal server. This happened when it was possible to have them signed, otherwise a verbal agreement has been obtained. In any case, copies of the IC have been left with the respondents to the interviews, either through paper copies or electronical copies.

[5] Smart water grid is defined as "the future water management platform". It integrates "information and communication technology (ICT) into a single water management scheme". It thus grants water quality and security through the use of ICT-based water management systems. Contrary to traditional systems, it allows for the quick identification of demands, and converge water accordingly. See Seung Won Lee, Sarper Sarp, Dong Jin Jeon & Joon Ha Kim (2015) *Smart water grid: the future water management platform, Desalination and Water Treatment*, 55:2, 339-346, DOI: 10.1080/19443994.2014.917887 for more details. See also Hajebi Saeed, Song Hui, Barrett, Stephen, Clarke, Aidan & Clarke, Siobhán (2013) *Towards a Reference Model for Water Smart Grid*, International Journal of Advances in Engineering, Science and Technology (IJAEST) for "measuring, sensing, optimising and detecting" the status of water and supporting infrastructure in smart grid systems.

[6] See in particular: the 2016 UNEG Norms and Standards (http://www.uneval.org/document/detail/1914), as well as the UNEG Code of Conduct for Evaluation in the UN system (http://www.unevaluation.org/document/detail/100), and the UNEG Ethical Guidelines for Evaluation (http://www.unevaluation.org/document/detail/2866).

Concerning the remote data collection, the informed consent has been sent by email before the virtual meeting, requesting its signature, and then mentioned again at the outset of the call. If the respondent has not be able to sign the consent and sent it back by email, the evaluators has obtained the consent verbally.

The issue of confidentiality has been presented at the beginning of the process. The evaluators have explained that they would not share anything discussed with anyone else outside of the evaluation team.

The ethical procedures applied in this evaluation have been presented in the Inception report and approved by the Ethical Committee before the data collection phase (please refer to Annex 7 for the Ethical Clearance).

3 Findings

The following sub-sections present findings against the evaluation questions, which are clustered under thematic sub-headings as in the TOR.

3.1 Relevance

Evaluation questions

1. To what extent are the Smart City Initiative objectives and activities tailored to the needs and capabilities of consumers and stakeholders, including the Ministry of Municipalities, Mayoralty of Baghdad and service providers?
2. Is it in line with the comparative advantage of UNICEF?

SCI objectives (as confirmed by the WASH team) and activities are relevant to the water supply needs of Baghdad Water Department and other water service providers, and potentially to consumers. However, the anticipated benefits of the SCI are yet to be achieved.

The SCI does not directly advance the reforms envisaged in the 2011 Road Map to Modernization such as regulation and private sector participation in the delivery of urban water supply services. It does, however, seek to address inefficiencies in service provision and maintenance, particularly the exceptionally high levels of consumption and UAW - challenges that are not limited to Baghdad. The most relevant interventions have been a nationwide public awareness campaign encouraging households to moderate their consumption[7]; development (though not yet implementation) of an online billing and complaints system for Baghdad; and the pilot introduction of smart meters.

The SCI-Pilot in Baghdad was relevant insofar as it introduced this technology to the Water Departments in Baghdad and Kirkuk and to MOB and MOCHPM, and showed the ease of meter reading compared to conventional meters. Service providers welcomed the technology as they recognised the need to modernise and professionalise service provision. The Pilot would have been far more relevant, however, had the meters been networked and a 'smart grid' created, enabling - as indicated in the evaluation TOR - real-time remote monitoring of consumption (and hence enabling better detection of leaks and unauthorised consumption) and automated meter reading. Smart meters on their own do not constitute a 'digitalised water safety and quality control system' as envisaged in the TOC and the absence of a smart grid was a major limitation of the pilot. Why it was not installed remains unclear, but the WASH team have indicated that they still hope to do this at some point in the future,

Regarding service provider capability, the scope of the pilot was quite modest in that it simply involved the installation of smart meters in a fairly small number of properties and training for service provider personnel in their use. At the time of the evaluation, BWD reported that all but three of the meters in Al Mansour were still operational, suggesting that maintaining them had not been too demanding.

For consumers, all or most of the targeted households in Al Mansour already had a water meter prior to the pilot, and the switch to smart meters made little difference to them since, as before, the meters were read once every six months by service provider personnel who visited the property. As with service providers, the relevance to consumers could potentially have been much greater if a smart grid had been set up, enabling rapid detection of leaks and automated meter reading.

It is important to note here that the pilot in Kirkuk operated in a very different policy and regulatory context, as volumetric charges were not permitted at all. The ET's understanding is that volumetric charges cannot be introduced until there is a change in policy and legislation, including a tariff reform, and that up to now there has not been strong political will to make the change. Instead, flat rate charges were applied based on the number of rooms in a property and the garden area. This arrangement did not change with the introduction of smart meters, so the relevance of the Pilot was limited to demonstration of the technology.

[7] It was beyond the scope of the evaluation to assess how effective this campaign had been, and no other third-party review was available.

As lead external support agency for the water sector, UNICEF is in a privileged position to advocate for, and provide strategic guidance to initiatives to improve urban water supply services within and beyond Baghdad. The SCI represents a good fit with this role.

UNICEF has a formally designated role as lead external support agency for the water sector in Iraq. As such it has good access both to the senior management of key public institutions and to government decision makers; it also has an important coordinating role among development partners in the sector. All of this puts UNICEF in a good position to identify sector needs; shape development agency responses; and influence sector policy and strategy. Supporting pilots to demonstrate technology or management systems that are new to service providers is a good fit with this strategic role, since UNICEF can bring them to the attention of decision makers, as has happened in this case – not only at BWD but also in MOCHPM, which now plans to expand the use of smart meters and introduce an online billing system, subject to legislation being passed to enable volumetric charges.

That said, it is doubtful that UNICEF would be well-placed to support city-wide water supply improvements directly. This is not a reflection on UNICEF's expertise or credibility; it is simply an observation that the Country Office does not have the human and financial resources in-house to take on such a huge task. It would be very unusual, globally, for a UNICEF country programme to do so.

The evaluators had limited opportunity to obtain insights on comparative advantage from other external support agencies and cannot comment on whether any are better placed to support urban water supply improvements. It is noted however, that the World Bank is developing a programme of IT support to BWD and, amongst other things, will be building on the earlier work undertaken by UNICEF on the development of an online billing system. The scope of the programme will not, however, extend to smart meters since UNICEF is currently helping BWD in this area.

3.2 Effectiveness

Evaluation questions

1. To what extent has the Smart Cities Initiative facilitated better management of the water service for its target population?
2. To what extent are the Smart Cities Initiative's monitoring and reporting mechanisms able to accurately capture initiative results, and is action taken in response to the findings?
3. To what extent has to the programme led to water saving?

Up to now, the anticipated benefits of the SCI are more aspirations than achievements. Evidence from the service provider and households indicates that the SCI-Pilot in Baghdad has not led to reduced water consumption or improved network management; while implementation of the online billing and complaints system developed with UNICEF support is still pending.

As noted above, the technology needed for easy leakage detection was never installed (and the ET was not able to fully understand why this did not happen). The consequent inability to monitor water consumption remotely was a significant limitation of the Pilot, hence easy detection of leaks or unauthorised consumption was not possible. BWD carried out some modest repairs to the local distribution network ahead of the installation of smart meters, but respondents identified no examples of improved network management thereafter. The household survey conducted for this evaluation (see Box 2 and Annex 3) found that low water pressure and poor water quality were ongoing concerns for customers, but beyond the scope of the Pilot.

Box 2. Summary of household survey findings

Key findings:

- **Having a smart meter made little difference from the consumers' point of view**. While the majority (51%) said that meters made them more careful about water consumption, 73% of the same respondents said they were using the same amount of water as before (these were high-income customers who already had meters before the pilot, and tariffs remained low).
- 75% felt that **service quality had not improved significantly since smart meter installation**. Two ongoing concerns, both beyond the remit of the pilot were:
    1. **Low water pressure**, making it necessary for households to invest in pumps and overhead tanks; and

2. A widespread **belief that the water was undrinkable** without further treatment (though the service provider and UNICEF both assert that it is potable). 87% of households used a domestic water filter and/or bought bottled water. See Annex 3 for more details on the survey,

Since the meters were not networked, reading was not automated. The ability to read meters without entering properties offered a potential efficiency improvement, but in practice this was not realised because meter readers also had to administer bills and collect payment at each property.

Regarding water saving, most respondents in the household survey said that their consumption was much the same now as before the installation of the smart meters. Six-monthly consumption data provided by BWD for the period June 2017 to January 2020 are presented in the table below[8] and, while the last of the four figures is roughly 9% lower than the first, six-monthly consumption rose by around 15% on average over the period. This confirms that the SCI-Pilot in Baghdad did not lead to water saving, but this is not surprising given especially that it targeted high-income households and tariffs remained very low throughout the Pilot, despite one modest increase[9].

Table 3 - Water consumption data for the Al Mansour pilot.

The data below were supplied by Baghdad Water Department. Each figure is the total recorded water consumption for the 149 properties supplied with smart meters in Al Mansour quarter.

Period		Total water consumption (m^3)
From	To	
30.06.17	01.01.18	97,173
01.07.18	01.01.19	146,665
01.01.19	30.06.19	99,316
30.06.19	01.01.20	88,283

Monitoring of the pilot has been inadequate, and this has limited the potential for lesson learning.

The title 'pilot' implies that a project has been set up to test something new (at least, new in a particular setting), assess its potential and learn lessons to improve its effectiveness before deciding whether to extend its use. It is surprising, therefore, that no baseline or results data were recorded for the pilot, even allowing for the fact that it lacked full project status within UNICEF programming.

By not adopting indicators of success and monitoring progress towards their achievement, opportunities were missed for learning lessons to inform the future use of smart meters within or beyond Baghdad. As noted above, the TOR mention the success of the pilot (including a reduction in water consumption), but no evidence to support this was identified by the evaluation. There is also no discussion or even acknowledgment in programme documents of the limitations of installing smart meters without the capacity to read them remotely or (in the case of Kirkuk) installing them in a location where volumetric charges are not permitted.

3.3 Efficiency

Evaluation questions answered in this section:

1. To what extent does the Smart City Initiative use its resources in a way that allows for cost monitoring and maximum achievement per dollar of investment?
2. To what extent is the initiative's structure (particularly with regards to human resources, cost driver management, monitoring systems) fit for purpose?

In the absence of information on project budget and expenditure data, it is very difficult to assess cost-efficiency, and the evaluation found no evidence that this has ever been attempted.

[8] The table shows data from 2017 because former years are not relevant to the evaluation since the pilot started in 2017. In addition, water consumption in the neighbourhood is expected to exceed Western countries consumption also in the previous years.

[9] An Increasing Block Tariff is used in Baghdad. According to BWD, tariffs were in the range 25 to 100 IQD ($0.02 to $0.07) per m^3 at the start of the pilot and the rate for the highest block was later increased to 120 IQD ($0.08).

UNICEF has not shared any collated data on budgets and expenditure for the SCI overall, or the SCI-Pilot in Baghdad in particular, though broader WASH programme budgets are available plus details of some isolated expenditure items such as the purchase of smart meters and associated IT equipment. That aside, assessing the cost-efficiency of the SCI would be difficult because of the absence of any real project framework or definitive statement as to what does, or does not, fall within its remit. There is nothing wrong with adopting and promoting such an approach, but the absence of clearly defined targets, and milestones; budget and expenditure data; and associated monitoring and reporting processes; makes it impossible to comment on whether the SCI has offered good value for money.

No dedicated team or institutional structure was set up to spearhead the initiative; activities were managed alongside other components of the country WASH programme. This is normal for UNICEF WASH programming globally, and for the smart meters pilot seems reasonable as it was a small operation. Even if it had been monitored more effectively, it would probably not have needed any full-time personnel, whether staff or consultants.

3.4 Impact

Evaluation questions

1. To what extent has the Smart City Initiative generated significant positive and negative, higher-level effects, both intended and unintended?
2. To what extent have the project's effects contributed (or not) to more equitable access to water services in Baghdad?

The SCI is appreciated by senior officials responsible for urban water supply, both in the Mayoralty of Baghdad and MOCHPM, which is responsible for urban water supply in other cities. They recognise the need to modernise and improve service provision and MOCHPM is now planning to extend the introduction of smart meters to three governorates using private finance.

The pilot has stimulated demand in government to extend the introduction of smart meters to other locations, though officials in Baghdad regretted that the SCI-Pilot in Baghdad did not introduce full 'smart' functionality including remote monitoring and automated meter reading. Notwithstanding these limitations, MOCHPM now plans to purchase an initial 60,000 smart meters for three governorates including Kirkuk. These will be installed without smart grids, but the ministry aims to add this component at a later stage and to adopt an online billing system. In the short term, the frequency of meter reading is to be increased to once every three months and new equipment will be purchased for issuing bills on the spot. To finance purchase of the meters, the ministry is entering into a joint venture with a private bank, Al Jenoob.

All of this is predicated, however, on securing legislative changes so that volumetric tariffs can be introduced; a tariff reform bill was drafted in 2014 but its enactment is pending. Whether the bill will be passed is unclear, but respondents noted that the political will to make water services financially self-sustaining is currently weak.

The reasons for BWD not implementing the online billing and complaints system developed with UNICEF support are not entirely clear, but a number of factors were cited by respondents. Initially, there were problems with the compatibility of the billing software with BWD's operating system. This was later resolved and an operational manual was produced in 2019. However, there remained some reluctance among BWD staff to adopt the system. Fear of job losses was cited as a reason by some, though others noted that BWD is already under-staffed, hence the concerns are unfounded. Another challenge cited was that Iraqi citizens tend to have a low opinion of public service providers and introducing an online complaints system in an atmosphere of distrust could simply add to BWD's problems. As a result, it was not seen as the right time for such an initiative.

Per capita water consumption in Baghdad is exceptionally high by global comparisons and tariffs are very low. Equity concerns relating to water supply are therefore not obvious, though reduced average consumption might improve access for those living on the outskirts of the city. The SCI-Pilot in Baghdad did not reduce consumption in targeted high-income households, however, and it is difficult to see how smart meters on their own could have any impact on equity of access to water.

Had a smart grid been established then the Pilot could have improved the detection of leaks and unauthorised consumption in the metered area. Given that the Pilot served only 149 properties, any reduction in losses would

have been too small to improve equity of access city-wide, but it would have demonstrated some further benefits of smart technology.

3.5 Sustainability

Evaluation questions

1. To what extent did capacity building approaches prepare technical staff, municipalities, the directorate of water and policy makers to continue maintaining infrastructure established as part of the project (i.e. smart meters, water network)?
2. Which aspects of the services provided by the project are likely to be replicable / not replicable in other Iraqi cities and why?

UNICEF provided technical training for service provider personnel in the use of smart meters. Those installed in Al Mansour remain mostly functional, though there are some isolated problems with Bluetooth connectivity. Capacity building in network maintenance, however, was beyond the scope of the SCI-Pilot in Baghdad.

The infrastructure installed under the Pilot comprised only smart meters and the means of reading them, hence the technical demands were fairly light. UNICEF provided training in use of the meters to service provider personnel in both Baghdad and Kirkuk, and respondents did not voice any concerns that staff were struggling to use or maintain them. According to BWD, only three of the 149 meters in Al Mansour were not working at the time of the evaluation and the household survey confirmed that the great majority were functional. There were, however, minor problems with Bluetooth connectivity at a small number of properties, so the meter reader had to enter in order to take a reading.

Had the Pilot included establishment of a smart network with remote monitoring and automated meter reading then further technical training and support would no doubt have been needed.

For the SCI more broadly, UNICEF has provided capacity building for service providers and other government partners in a number of areas, not all related to infrastructure maintenance. These include, for example, use of the proposed online billing and complaints system and water safety planning. It is acknowledged here that UNICEF's regular programming, including its capacity building work, was interrupted for a prolonged period by the ISIL emergency from 2014-17.

While it would be possible to install smart meters in other cities, there would be little point in doing so while billing is based on property size and garden area rather than actual water consumption. Even if changes in policy and legislation allowed volumetric tariffs to be introduced, the benefits of installing smart meters rather than conventional ones would be very limited unless smart grids (as described in the TOR; and also see footnote 5 in section 2.2) were also established.

The evaluation TOR indicate that UNICEF plans to scale up the SCI in the short term, though programme documents seen by the consultants do not give a high profile to urban work over the 2020-2024 period and it is unclear what funding is available. The most relevant references seen are:

1. *ICO WASH Program Strategic Note (2019).* The Integrated Resources and Results Framework makes no reference to urban WASH though the narrative briefly mentions support to research on urban WASH issues under 'Evidence generation, policy dialogue and advocacy'.

2. *WASH Programme Strategic Note, Priorities and Way Forward for 2021*. This says that the 2020-2024 programme aims to deliver results in three areas: enabling environment; schools and health care facilities; and communities. Under enabling environment, the SCI is mentioned as an example, but there is no elaboration – the note pays more attention to the ongoing pandemic and climate resilience.

Since UNICEF has already demonstrated smart meters on a stand-alone basis to MOB and MOCHPM in two locations, it would be hard to justify doing the same again elsewhere. Potentially, much more could be gained by building on what has been done in Baghdad, where volumetric tariffs are already established, and establishing a truly 'smart' system that enables remote monitoring and is linked to an online billing system. The consultants do not have any information on the resources available, but with World Bank set

to take forward the work on billing, there could in principle be scope to demonstrate full smart functionality as a collaborative initiative with World Bank and BWD; see recommendations.

3.6 Synergies

Evaluation questions

1. How effective was partner coordination in the Smart City Initiative?
2. In what ways were different stakeholders' efforts coordinated and complementary (or not)?

No dedicated co-ordination platform was set up to monitor the SCI-Pilot in Baghdad or the SCI overall, but the pilot involved very few institutional stakeholders, hence the co-ordination needs were modest.

The Pilotinvolved just two institutional stakeholders: the service provider, BWD (under the Mayoralty of Baghdad) and UNICEF. Co-ordination demands were therefore light, and collaboration was facilitated by appointing a senior BWD official as the focal point of contact with UNICEF – an arrangement that continues. In much the same way, UNICEF liaises with a designated focal person in MOCHPM which has overall responsibility for water supply in towns and cities beyond Baghdad.

There appears to be an effective working relationship with BWD, but no mechanisms were adopted for consulting users of the smart meters over the course of the Pilot. This said, the main limitation here was not the lack of a co-ordination mechanism but UNICEF's limited engagement in the Pilot beyond overseeing a contractor to install the meters and arranging training for service provider personnel. Processes for monitoring and learning from the Pilot were largely absent, as noted in 2.2 above.

Beyond the Pilot, some other activities under the SCI umbrella had their own co-ordination arrangements. The EU-funded awareness campaign on water conservation, for example, established task forces at national and sub-national level. These apparently still exist, though it is unclear whether they remain active.

In non-emergency contexts the main vehicle for co-ordination between UNICEF and government stakeholders in the sector is currently a monthly meeting with water service providers from Baghdad and beyond – an arrangement that has been in place for some time and is not SCI-specific. Co-ordination and communication between UNICEF and other international development agencies in the sector is also reported as good, though much of it happens on an informal basis.

A positive example of co-ordination within government under the SCI is UNICEF's ongoing work to make water quality data produced by the Ministry of Health publicly accessible via the BWD website. Depending on what the data shows, this could either allay public fears about water quality or create pressure for BWD to make improvements. That said, it is noted that the website was down for the entire period of the evaluation and it is unclear when it will be operational again.

3.7 Gender

Evaluation question: To what extent has this initiative's design and monitoring taken gender into consideration?

There was no explicit gender dimension to the design or monitoring of the SCI. However, given the narrow technical focus of the SCI-Pilot in Baghdad and the unusual context of excessive water consumption city-wide, the gender-related aspects of the Pilot, and the SCI overall, are not obvious.

Gender and equity are priority concerns in UNICEF programming and **the evaluation found no evidence of any substantive gender-related challenges being neglected.** Rather, none were identified, bearing in mind that all of the properties had their own private tap so that access was safe and unrestricted; water was very cheap; and there were no challenges in terms of queueing or carrying water. Some respondents nevertheless highlighted two gender-related benefits of the pilot. Firstly, the training UNICEF provided in the use and maintenance of smart meters included a significant number of female personnel from the service providers in Baghdad and Kirkuk. Secondly, the pilot provided a security benefit to women and girls in the since meter readings could now be taken without entering a property. On the second point, this seems logical, however it is also noted that:

1. BWD staff issue bills and collect cash payments when making their six-monthly visits to read meters, so they need to talk to householders irrespective of the presence of smart meters.
2. During the household survey it was evident that the local meter reader was well-known to households in Al Mansour quarter and trusted by them. They had no concerns with him entering their property.

4 Conclusions and Recommendations

4.1 Conclusions

The **SCI-Pilot in Baghdad and the SCI overall**, **have not, so far, achieved the objectives of reduced water consumption and improved network management**, however broadly that is defined. The ambitions of the Pilot were clearly unrealistic given that smart meters were installed without the capacity for remote, real-time monitoring or links to an online billing system; and in an environment where tariffs were too low to incentivise households (least of all high-income households) to moderate their consumption. In Kirkuk, volumetric water charges were not permitted at all under the prevailing policy and regulatory framework, which further reduced the value of the pilot, and it is unclear whether or when this arrangement will change.

The installation of smart meters as a stand-alone intervention is unlikely to trigger a change in household water consumption and offers no means of improving network management in the absence of a smart grid. The content of the SCI-Pilot in Baghdad was actually at odds with the SCI Theory of Change which envisages more comprehensive interventions including development of a 'digitalized water safety and control system' (i.e. a smart grid).

The SCI vision was over-optimistic about what can be achieved by IT alone. The ambitions of the initiative (not only the Pilot but also implementation of the online billing system) have been frustrated by longstanding policy and institutional challenges and the reforms envisaged in the 2011 Road Map have yet to be implemented. Tariffs remain unrealistically low, service providers are heavily dependent on operating subsidies from government and there is no real incentive for them to transform into financially sustainable utilities run on a business-like basis. **In an unreformed environment, IT improvements can only make a limited impact on the quality and sustainability of service provision**.

The Pilot was more successful in introducing smart meter technology and its potential benefits to service providers and other government partners within and beyond Baghdad, even though full 'smart' functionality was not established. The MOCHPM plan to introduce smart meters in three governorates is testament to this, though again there are no plans to establish smart networks in the short term, and the initiative is predicated on legislation being passed to enable the introduction of volumetric tariffs.

Beyond the Pilot, the online billing and complaints system developed with UNICEF support has not been implemented by BWD up to now, but the groundwork undertaken has provided a foundation that can potentially be built on by BWD – provisionally via the proposed World Bank programme if the current hesitancy in BWD can be overcome.

Given the points above, **the results** of the Pilot are not surprising but **would have come to light much sooner had the Pilot been monitored** and results reported beyond the completion of meter installation. With pilot projects, indeed, it is important to be open about successes and challenges and be willing to change course where evidence shows this to be necessary, in order to maximise learning for UNICEF. But this cannot be achieved if a solid monitoring system is not in place. Opportunities to learn lessons and potentially modify the scope of the Pilot were thus missed.

As far as UNICEF's contribution is concerned, **the agency is in a privileged position to advocate** for and provide strategic guidance to initiatives to improve urban water supply services within and beyond Baghdad. It is however doubtful that the UNICEF Country Office would have the in-house human and financial resources to directly support water supply improvements.

4.2 Recommendations

Draft recommendations were shared with the Evaluation Steering Committee in the evaluation de-briefing meeting, and feedback from that meeting informed the composition of final recommendations as set out below.

UNICEF's intentions regarding further work on smart metering have only been expressed in general terms as a desire to scale up, and in the absence of a project document, budget or workplan it is not possible to assign specific timeframes to the recommendations. The last point is offered as "food for thought" as it concerns smart metering in general, not the specific project under review.

1. **Repeating the installation of smart meters on a stand-alone basis, and in locations where volumetric charges are not permitted, should be avoided. Instead, UNICEF should encourage (and potentially support, if funds are available) the demonstration of full smart functionality, as described in the evaluation TOR (i.e. installing and testing a networked smart water grids that automate water monitoring and control), ideally by building on the SCI-Pilot in Baghdad.**

   Notwithstanding the governance challenges outlined above, such an intervention could demonstrate what can be achieved when real time, remote monitoring is possible across the metered location. Doing so would be in line with the priorities set out in the ICO WASH Program Strategic Notes from 2019 and 2021, which envisage urban WASH support at a strategic level, helping to foster an enabling environment for progress via evidence generation and associated advocacy.
   Responsible Actor: UNICEF

2. **When planning future activities under the SCI, UNICEF should set objectives that are realistic in terms of what IT improvements can deliver on their own.**

   For example, if a smart network is established as proposed above, it could help BWD to reduce unaccounted for water through more efficient identification of leaks and unauthorised connections. It would not however, incentivise households to reduce their water consumption so long as while tariffs remained very low.
   Responsible Actor: UNICEF

3. **UNICEF (and other development partners) should continue to advocate for implementation of the reforms envisaged in the 2011 Road Map** (including the introduction of an independent regulator and substantive private sector participation in service delivery, as well as the application of a tariff reform). **The need for an updating of the Road Map should be further explored by UNICEF.**
   Responsible Actor: UNICEF

4. **For any future project, including a pilot, UNICEF should set out the purpose, objectives and expected results in a project document and results framework** that explain clearly the rationale for the project including the particular issue or challenge it is trying to address and how this will (potentially) be achieved. Targets, milestones, indicators, budget and expenditure data should be clearly defined. If needed, a baseline should be established at or before the start-up of the project.
   Responsible Actor: UNICEF

5. **Thereafter, UNICEF and their implementing partners should monitor any future project, including a pilot, closely to track what changes are achieved against the project document, the results framework and, if available, a documented baseline.**

   Specifically, UNICEF should explore the need for hiring an external M&E consultant to assist UNICEF WASH Team in building a solid monitoring system. Operational monitoring would not need any full-time personnel, whether staff or consultants.
   Responsible Actor: UNICEF

– **In the longer term, should tariff reform be introduced along with strong incentives to make services financially sustainable, there could be value in exploring how smart meters can play a more targeted role in ensuring access to sufficient water for the urban poor.**

In some other countries (Niger and Kenya, for example) [10] there have been promising initiatives in pre-payment for water using mobile phones, with smart meters used to monitor and control the volume of water dispensed.

[10] See https://www.gsma.com/mobilefordevelopment/wp-content/uploads/2019/09/CityTaps-Enabling-prepaid-water-services-for-the-urban-poor.pdf; and https://www.wsup.com/content/uploads/2021/02/The-Veolia-Institute-Review-Essential-Services-in-Africa-p78-SDrabble-RCampbell-PhOyamo-RRenouf.pdf

ANNEX 1. TERMS OF REFERENCES

Terms of Reference UNICEF IRAQ Evaluation of the WASH Smart City Initiative Pilot Project in Baghdad

Background

Global Context

1. The United Nations Convention on the Rights of the Child, which forms the basis of UNICEF's work, is the first legally binding international instrument to incorporate the full range of cultural, economic, political and social rights for children. The 2030 Agenda for Sustainable Development, established in 2015, reaffirmed a global commitment to ensuring the "availability and sustainable management of water and sanitation for all" (SDG 6). Safe drinking water and hygienic toilets protect people from disease and enable societies to be more productive economically.

Iraqi Context

2. The Middle East in general, and Iraq in particular, faces challenges to provide enough quality water to its population due to decades of decreasing water levels in the Tigris and Euphrates rivers. The Tigris and Euphrates rivers provide 98% of water consumed in Iraq, but also pass through Turkey and Iran, respectively. Turkey and Iran store huge quantities of water in dams constructed upstream which, combined with climate and environmental changes like reduced rainfall, exacerbate the water crisis[11]. The quantity of water in the Euphrates and Tigris is expected to decline by 50% and 25% respectively by 2025 unless efficient water supply management systems are introduced. Unless water management is improved, the water crisis will continue with increasingly severe consequences for the health of Iraq's population and the country's economy.

3. Both Iraq's population and rate of urbanization are rising rapidly, which has raised demand for water. Existing water infrastructure is not sufficient to provide quality water to the population because it is both inefficient and poorly maintained. Per capita water consumption in Iraq is 327 litres / person / day on average, as compared to 150 litres / person / day in EU countries. The overuse and misuse of water are due to the fact that in most areas, water consumption is not metered[12] and domestic water is highly subsidized (USD 0.0034 / m3). Water sector revenues are therefore not enough to cover more than 5% of the water system's operation and maintenance costs. The agricultural sector alone utilizes 90% of available raw water resources. Millions of people in Iraq are deprived of their right to safe drinking water because the government has struggled to regulate and manage Iraq's water resources.

4. In summary, the main problems facing domestic water supply in Iraq are:

- Reduced river water availability because of drought and increased demand in upstream countries
- Water quality deterioration and increased health risk, especially in the central and southern governorates, due to reduced river flows and weak environmental law enforcement
- High consumption rates that exceed the average rates in industrialised countries
- Low supply efficiency due to high losses (estimated loss is more than 50%)
- Lack of water policy, institutional restructuring or efficient management of the sector
- Lack of comprehensive and integrated monitoring system for the water supply chain
- Lack of public awareness on water use efficiency or the associated health risk
- Inefficient operation and maintenance procedures.

5. UNICEF has long been active in the global WASH sector, particularly in humanitarian settings. In Iraq, capacity development of national partners is a core part of UNICEF's programming. This capacity building approach is aligned with the Country Programme, the Regional Refugee and Resilience Plan and the Iraq Humanitarian Response Plan in that this approach prepares the Iraqi WASH sector for the eventual transition from humanitarian to development programming. In the WASH sector, UNICEF has been particularly involved in the capacity building and infrastructure updating aspects of the Iraq Public Sector Modernization Project Phase II (IPSM-II), both of which aim to provide more rights holders in Iraq with equitable access to water. UNICEF and UN-Habitat are working in cooperation with other United Nations agency to implement this modernization project, with the ultimate goal of creating a modern and efficient public sector, particularly in the areas of health, education, water and sanitation.

SMART City Initiative

6. Through UNICEF Iraq's WASH section's close collaboration with the Iraqi Ministry of Municipalities, Mayoralty of Baghdad and Kirkuk Directorate of Water, UNICEF supported the adoption of a 'Smart City' initiative. The initiative promotes improved national capacity for water conservation and management, combined with enhanced public access to water monitoring and online billing, through e-Governance under joint initiatives as part of the Iraq Public Sector Modernization Project Phase II (IPSM-II). A smart city is one that uses electronically collected data to improve efficiency in resource use and service provision. The Smart City Initiative in Iraq aims to improve capacity for water conservation, improve water management and enhance public access to water.

7. The Smart City Initiative, in addition to providing smart meters, also provides an online water and municipal services billing and complaint system. This accelerates the collecting of water bills, improves water service provision and makes sector governance more sustainable through an efficient cost-recovery and complaints management system.

[11] Iraq relies mainly on surface water from international riparian rivers.

[12] In Baghdad, 90% of installed water meters at household level are not functional.

8. UNICEF began planning and coordinating with partners for a Smart City Initiative pilot project in 2018, and the pilot began in Baghdad and Kirkuk cities in 2019. The Smart City Initiative in Baghdad and Kirkuk consists of installing smart meters that replace manual meters, rolling out the smart meter software, developing a complaint system for customers to communicate directly with water service providers, and establishing an online billing system. This work is done using networked smart water grids that automate water monitoring and control. The smart water meters are installed to establish water consumption patterns using predictive analysis, reduce operational costs, and streamline the water supply management and improve water service delivery to subscribers, including in marginalized and socially deprived areas in Baghdad and Kirkuk. By doing this work, the initiative also aims to enhance government capacity for water auditing, boost consumer confidence and increase water sector revenue.
9. The overarching goal is to reduce water consumption levels, improve network management and reduce wastages and illegal connections through the implementation of sustainable solutions to the water crisis, water misuse and overuse and its endorsement by the political authorities and affected population.
10. In Baghdad and Kirkuk cities, the Smart City Initiative has introduced Information and Communication Technology (ICT) platforms to solve water sector issues including water leaks, over-use, water quality issues, and response to drought and natural disasters. In partnership with the Mayoralty of Bagdad, UNICEF has provided technical and financial support as part of this initiative to develop an online billing for water and municipal services. In Kirkuk, UNICEF provided similar support but worked in partnership with the Ministry of Municipalities. In 2020, UNICEF Iraq's WASH Section and partners are working to scale the Smart City Initiative to other parts of the country, and the Ministry of Municipalities will be UNICEF's main partner on the smart city initiative in these other locales. During 2020 the UNICEF Iraq WASH section also plans to link the Smart City infrastructure in Baghdad with its water safety planning infrastructure by introducing new software that can monitor both water usage and quality.
11. In 2018 alone, more than 650,000 subscribers whose water service provider is the Mayoralty of Baghdad accessed the newly established, public web-based online water billing and complaints system and 16,000 inhabitants of Baghdad and Kirkuk cities reduced their water consumption through early leakage detection. The Smart City Initiative also conducts capacity training on data management for federal technical staff and operations and management training for staff working on the new water billing system.

Theory of Change

12. The Smart Cities Initiative Theory of Change (ToC) stipulates that an online water billing and complaints system combined with digitalized water safety and quality control systems will allow consumers and civil society organizations to better monitor their water usage. This increased monitoring capability, alongside a concerted effort to increase public knowledge about the financial and environmental impact of water mismanagement and overuse, should lead consumers to decrease their daily water usage. Decreased usage, when coupled with improved water management infrastructure, will lead to a more environmentally friendly water supply system management approach that is financially efficient and reduces water misuse and overuse. This approach is aligned with the infrastructure improvements and capacity building goals outlined in the Iraqi government's Iraq Public Sector Modernization Project Phase II (IPSM-II). A more detailed ToC, which was the result of a 2018 causality analysis conducted by UNICEF Iraq Country Office (ICO) on the WASH sector, is represented in Annex 1 and provides a key reference for the evaluation of the initiative.
13. This ToC assumes that there is a direct link between technical assistance and improvements in water management practices, and that improved water management will actually lead to sufficient and timely water quantity and quality. The ToC also assumes that consumers are able to use the smart water system to monitor and decrease their water consumption, that this monitoring will result in improved household water availability and that smart city farming techniques will lead to lower water usage in the agricultural sectors.

Purpose and Objectives

Purpose

14. The purpose of the evaluation is to independently examine the extent to which the smart city initiative has improved water management, having better data to monitor water wastage and provision in Baghdad city. This analysis will then inform efforts to replicate the smart water initiative across Iraq and UNICEF's efforts to contribute to SDGs 6.1, 6.3 and 6.4.

Objective

15. The UNICEF Iraq WASH Section has plans to scale the SMART City initiative in the short-term, so all findings from this evaluation will inform decisions and planning for bringing the initiative to scale.
16. The specific objectives of the evaluation are:

- Assess the extent to which the smart city initiative has improved water management and provision in Baghdad city by documenting the initiative's achievements and limitations.
- Assess the capacity of the consumers and key stakeholders to sustain the smart water meters installations
- Provide evidence of the intervention's successes and failures in terms of technical, financial and managerial practices in order to facilitate future planning of such projects.
- Examine the scalability of the intervention in terms of relevant legal regulations and stakeholder roles and responsibilities

Scope

17. The evaluation will assess the extent to which the project achieved its objectives, its relevance to the needs of rights holders, and how efficient, effective, sustainable and coordinated the smart city initiative pilot in Baghdad has been. The evaluation exercise will cover the smart water meter programming in Baghdad over the last two years (2018-2019). Smart water meter programming has taken place in the Al Mansour quarter, where roughly 250 households and a number of public buildings, schools, and a mosque have received smart meters. Customer surveying is ongoing and has been focused until now on the Al Mansour quarter. Customer surveying gives a clearer picture of daily water consumption patterns as well as the unexpected internal leakage or seepages that household experience. The evaluation will look into all components of the

smart city project including the work at the Ministry of Municipalities level systems. For future visioning and scaling up of the project some information will be collected in Kirkuk.

Evaluation Questions

18. The key questions for this evaluation were formulated mainly based on a selective combination of the OECD DAC criteria and the ALNAP criteria. This evaluation will examine the following domains of the intervention: (i) relevance, (ii) effectiveness, (iii) efficiency, (iv) impact (v) sustainability, (vi) synergies and (vii) gender. The evaluation will examine all these criteria using gender, equity and human right-based approaches. Conducting the evaluation in this way will facilitate learning for decision makers as they craft interventions and seek sustainable results. It will also allow those involved in programme design and administration to adjust the programming as needed. The evaluation aims to answer the following questions:

Relevance

- To what extent are the smart city initiative objectives and activities tailored to the needs and capabilities of consumers and stakeholders, including the Ministry of Municipalities, Mayoralty of Baghdad and service providers?
- Is it in line with the comparative advantage of UNICEF?

Effectiveness

- To what extent has the Smart Cities Initiative facilitated increased access to quality water and better water management practices for its target population, particularly disadvantaged and vulnerable population groups?
- To what extent are the Smart Cities Initiative's monitoring and reporting mechanisms able to accurately capture initiative results and act on resulting insights?
  To what extent has to programme led to water saving?

Efficiency

- To what extent does the smart city initiative use its resources in a way that allows for cost monitoring and maximum achievement per dollar of investment?
- To what extent is the initiative's structure (particularly with regards to human resources, cost driver management, monitoring systems) fit for purpose, particularly as compared to the alternative water metering systems?

Impact

- To what extent has the Smart City Initiative generated significant positive and negative, higher-level effects, both intended and unintended?
- To what extent have the project's effects contributed (or not) to more equitable access to water services in Baghdad?

Sustainability

- To what extent did capacity building approaches prepare technical staff, municipalities, the directorate of water and policymakers to continue maintaining infrastructure established as part of the project (i.e. smart meters, water network)?
- Which aspects of the services provided by the project are likely to be replicable / not replicable in other Iraqi cities and why?

Synergies

- How effective was partner coordination in the Smart City Initiative?
- In what ways were different stakeholders' efforts coordinated and complementary (or not)?

Gender

- To what extent has this initiative's design and monitoring taken gender into consideration?

Stakeholders

The stakeholders involved in this evaluation are the Ministry of Municipalities, Mayoralty of Baghdad, water service providers, the Council of Ministers Secretariat and the UNICEF WASH section. The Mayoralty of Baghdad has served as UNICEF's major partner in the Baghdad smart city programming, while the Ministry of Municipalities has been the major partner in the Kirkuk programming and will be involved in the national scaling of the smart city initiative. The Council of Ministers Secretariat is currently working on a strategy to apply a more widespread e-governance system and is therefore interested in learning from the experience of the smart cities initiative. Other UN agencies working in the field on similar initiatives like UNDP, UNHABITAT and the World Bank.

Methodology

The evaluation will take place during the time of continued restrictions due to COVID-19, therefore; the viability of various methods needs to be appropriate to the prevailing situation, giving the flexibility to adjust depending on what is applicable and what is not.

19. A mixed methodology composed of qualitative data collection as well as secondary data review is required to carry out this evaluation. The gender, equity, human and child rights principles should be incorporated into every step of the evaluation process, from design to analysis. The methodology is based on UNEG norms and standards and refers to relevant UNEG and UNICEF guidance materials such as the guidance on integrating human rights and gender into evaluation. The consultant's data analysis approach should ensure that the evaluation purpose, objectives and questions are comprehensively addressed.

20. The evaluation team will determine the data requirements and define the procedures for collecting data on a) smart water meters and water network installation, b) the water supply system (quantity, quality, seasonal fluctuations), c) the quality and reliability of the real-time two way data transmission, d) water network and smart meter operations and management practices, e) water system leakages and losses, and f) the tariff levels. All activities conducted to review the

water supply system's performance will disaggregate results by gender and examine each research question from a gender lens.
21. In the areas where the project is implemented, the evaluation team will measure the flow and pressure at appropriate points of the system as required, in consultation with the Mayoralty of Baghdad, and will assess weaknesses or strengths of the existing water supply system by comparing the one in the project area with a given water supply system out of the project area. The evaluation team, in consultation with the UNICEF WASH Section and the local service providers, will choose a water supply system for comparison. Based on this analysis, the consultants will identify the underlying causes for non-performance and non-adherence to standards.
22. The evaluation team will also perform a sample survey of households who have been provided with smart water meters by the Smart Cities Initiative; all of these households are located in the Al Mansour quarter. The survey will investigate the ratio of the smart water meters that are functional, the profile of household beneficiaries (number, revenue, level of education of household members), household consumption level and household satisfaction with the online billing and complaints feedback mechanism. The evaluation team will generate a sample for the household survey with the WASH Section's support. Additional survey questions will examine household experience with the smart water meters from a gender and human rights perspective. Survey data will be disaggregated by gender.
23. The mixed methods approach will consist of:

- Administration of questionnaires to a sample of households in the Al Mansour quarter of Baghdad;
- Qualitative and quantitative analysis of service provider records detailing customer water usage and customer-service provider interactions;
- Focus Group Discussions (FGDs) with members of technical staff from Ministry of Municipalities, Mayoralty of Baghdad, service providers, consumers and UNICEF WASH Section personnel involved in the project;
- Key informant interviews with technical and non-technical staff from Ministry of Municipalities, Mayoralty of Baghdad, service providers, consumers and UNICEF Wash personnel involved in the project;
- Technical analysis of water management infrastructure

24. The consultants will develop a more detailed methodology that will use these methods, and any other methods necessary, to complete the tasks listed below and other tasks they feel relevant to the evaluation questions listed above. The consultants will propose the overall methodology, including questionnaire content and FGD guides, in the inception report, which will be approved by UNICEF Iraq before the evaluation begins. Prior to the inception report, the evaluation team is expected to review relevant programme documents including, but not limited to:

- Country programme document
- Online Water Billing & Complaints System for the Mayoralty of Baghdad Manual
- Iraq Public Sector Modernization Program functional reviews and service delivery reports for the water and sanitation sector
- Iraq Public Sector Modernization Program costing studies
- Iraq Public Sector Modernization Program road map
- Online billing and complaints reports
- ToRs for smart meter and online billing service providers
- Smart city knowledge management reports

25. The evaluation team will need to secure the necessary research permissions to conduct this research, and the Evaluation Manager will work with the evaluation team to facilitate this process during evaluation inception phase. The evaluation team's inception report will include a detailed account of the proposed research methodology as well as all informed consent scripts, survey questions and other data collection materials.

Governance

26. The Research and Evaluation Specialist will manage the evaluation The Evaluation Manager will provide quality assurance for the evaluation process and particularly on all deliverables: (a) the inception report; (b) the preliminary findings presentation and (c) the draft report.
27. The Evaluation Manager will act as secretariat for the Steering Committee. The Steering Committee is a group of stakeholders that provides input and guidance during the evaluation process. The Steering Committee will endorse the terms of reference and the inception report. All key stakeholders will provide feedback on preliminary findings and endorse the evaluation report.
28. Any unforeseen events and challenges that the evaluation might face should be discussed in the Steering Committee. Terms of reference of the Steering Committee will be shared and discussed by the members.
29. The Chief of WASH section will ensure that all relevant documentation is available to the consultants and will support with arranging evaluation team meetings with relevant stakeholders. The consultants' team leader will coordinate the inputs of the team and be responsible for the quality of the deliverables.
30. The evaluation team will work closely with the response partners, both governmental and non-governmental, during the evaluation. The Evaluation Manager and UNICEF partners will provide specific information on stakeholders. The Evaluation Manager will also support any coordination which might be deemed necessary. All local travel should be discussed and approved by the Evaluation Manager in advance.

Limitations

31. The evaluation will not conduct research with members of the population who have not been involved in the Smart City Initiative thus far; while this will certainly limit the diversity of viewpoints available, it will also help to focus this evaluation on determining the extent to which the intervention has been helpful for those engaging with it directly. This is an evaluation of a pilot project that took place in two cities; however, the evaluation will only cover one of these two cities; findings may have limited applicability to other areas in which UNICEF Iraq operates.

Deliverables

32. The contract will have the following deliverables: inception report (including questionnaires, focus group guides, informed consent scripts and all other materials needed to conduct field research), presentation of preliminary findings, draft report, final report and response to the comment matrix. The timeline is laid out in the table below, noting that it starts with the actual work and it does not include some additional time prior to the work for the team mobilization. In several of the stages, more than one person will work on the deliverable in parallel.

Task	Timeline	Deliverable	Responsibility
Desk review and draft inception report detailing the consultant's understanding of the ToRs, methodology, workplan, deliverables	One week	Draft inception report	Evaluation Team
Acceptance of inception report	Two weeks	Final inception report	Evaluation Manager / Steering Committee
Data collection and analysis	Five weeks	Interim reports on activities, verbal or written, to the Evaluation Manager Presentation of preliminary key findings from the field to the Steering Committee	Evaluation Team Steering Committee gives comments on preliminary findings
Draft evaluation report	Three weeks	Draft report	Evaluation Team

33. The inception report must include the proposed methodology, interview guides and informed consent documents translated into the languages to be used in the field, as appropriate. The evaluation team will produce a high-quality evaluation report in line with UNICEF-adapted UNEG Evaluation Report Standards. The report will have an executive summary suitable for national and international circulation and reporting information of sufficient value for informed decision-making, learning, and accountability. The report must include action-oriented recommendations, required adjustments, potential alternative ways of implementation and lessons learnt from the project supported by facts from the field.

Team Composition

34. UNICEF is looking for an experienced multi-disciplinary team of consultants (both international and national) with experience in designing and conducting evaluation for WASH humanitarian response in an emergency context. The Evaluation Team is expected to be mixed in teams of gender and cultural backgrounds. Evaluation Team's proposal must include a detailed plan of how these translation and interpretation will be provided.

35. The below table sets out the tentative workload of the different specialists, as well as the required skills for the different team members. The number of days is indicative as the actual time will change depending upon the proposal of the consultants. The consultants might consider a different team composition if justified. The team would have to explain how it will deal with translation and interpretation if required. Any proposed changes to the team composition should be justified in the consultants' proposal.

Team member	Number of days proposed
Team leader	45
Urban Systems Governance Specialist	30
Water Management Specialist	30

Team leader / Evaluation Specialist	• Relevant master's degree (evaluation, development studies, economics, social science, etc.) • Experience in managing evaluations in the UN system and managing a team • Ability to conduct statistical analyses • Proven ability to produce high-quality reports • Good understanding of integrating gender, equity, human and child rights into evaluations • Strong interpersonal skills • Ability to work with senior officials • Cultural sensitivity • Fluency in English, proficiency in Arabic (preferred)
Urban Systems Governance Specialist	• Master's degree in public finance, economics, public accounts, political or social science or other relevant field

	with at least 5 years of experience in financial management • 3-5 years of experience designing and conducting survey research • Experience analysing local resource allocation decisions and advising on governmental budget management in complex environments • Experience analysing city subsidy policies, financial viability, and creditworthiness • Strong interpersonal skills • Ability to work with senior officials • Cultural sensitivity. • Fluency in English, proficiency in Arabic
Water Management Specialist	• Master's degree in hydrology, climatology, geography, civil engineering, or related • 3-5 years of experience designing and conducting hydrogeological investigations, particularly for evaluating water conservation and water supply forecasting data • Experience analysing water supply issues and municipal water projects • Ability to interpret water quality results and suggest chemical dosage changes to treatment process • Strong interpersonal skills • Ability to work with senior officials • Cultural sensitivity. • Fluency in English, proficiency in Arabic

Ethical Considerations

36. The evaluation consists of an exhaustive and rigorous analysis of the Smart City Initiative implemented in Baghdad city. The evaluation shall take into consideration certain professional and ethical requirements, including:

- Anonymity and confidentiality: the evaluation must respect the right of individuals to provide information while ensuring anonymity and confidentiality.
- Responsibility: any disagreement or difference of opinion that may arise between the members of the team, or between consultants and UNICEF Iraq, relating to the conclusions and / or recommendations should be mentioned in the report. All claims must be supported by the team or have a disagreement noted.
- Integrity: the evaluation team will be responsible for highlighting questions that are not specifically mentioned in this ToR, if necessary, for obtaining a more complete analysis.
- Independence: the evaluation team must not have links or personal interests in the Smart City Initiative, its management or any of its components.
- Validation of the information: the evaluation team must ensure the veracity of the compiled information and will be ultimately responsible for the information presented in the evaluation report.
- Evaluation report: the dissemination of the information compiled, and the final report is the sole responsibility of UNICEF Iraq.

Payment

37. Payment is contingent on clearance by the Evaluation Manager and will be made in three instalments:

- 20 percent after the inception report
- 30 percent after the presentation of preliminary findings
- 50 percent on completion of all deliverable to the satisfaction of UNICEF

Location

38. The work will be home based except for the duration of the field work in Iraq.

ICT Considerations

39. The evaluation team will require access to some of the UNICEF internal databases and documents.

Evaluation of Proposal

40. Given that the company has been preselected in the LTA process, proposals will be assessed based on whether the CVs of the proposed team members match the evaluation ToR's requirements as well as the overall team's availability and the price. The team CVs will be assessed based on appropriateness and, if appropriate, proposals will be selected based on price. Each proposal should include the following:

- Curriculum vitae for all team members in English
- Financial proposal

41. All proposals should be sent to UNICEF Iraq Bids at irqtender@unicef.org A Bid Selection Committee will review all applications as they arrive.

Unsatisfactory Performance

42. In case of unsatisfactory performance, payment will be withheld until quality deliverables are submitted. If the selected institution is unable to complete the assignment, the contract will be terminated by notification letter sent 30 days prior to the termination date. In the meantime, UNICEF will initiate another selection process to identify appropriate candidate.

Conditions and Administrative Issues

43. The contractor will work on its own computer(s) and use its own office resources and materials in the execution of this assignment. The contractor's fee shall therefore be inclusive of all office administrative costs.

44. Granting access to UNICEF ICT resources for consultants / non-staff is considered as 'exception,' and therefore shall only be granted upon authorization by the head of the office on justification / need basis. This includes creation of a UNICEF email address, as well as access to ICT equipment such as laptops and mobile devices.

45. All evaluation consultants must uphold the UNEG Code of Conduct for Evaluation in the United Nations system. All persons engaged under a UNICEF service contract, either directly through an individual contract, or indirectly through an institutional contract, shall be subject to the UN Supplier Code of Conduct: https://www.ungm.org/Public/CodeOfConduct

46. Please also see UNICEF's Standard Terms and Conditions attached.

ANNEX 1: SMART City Initiative Theory of Change

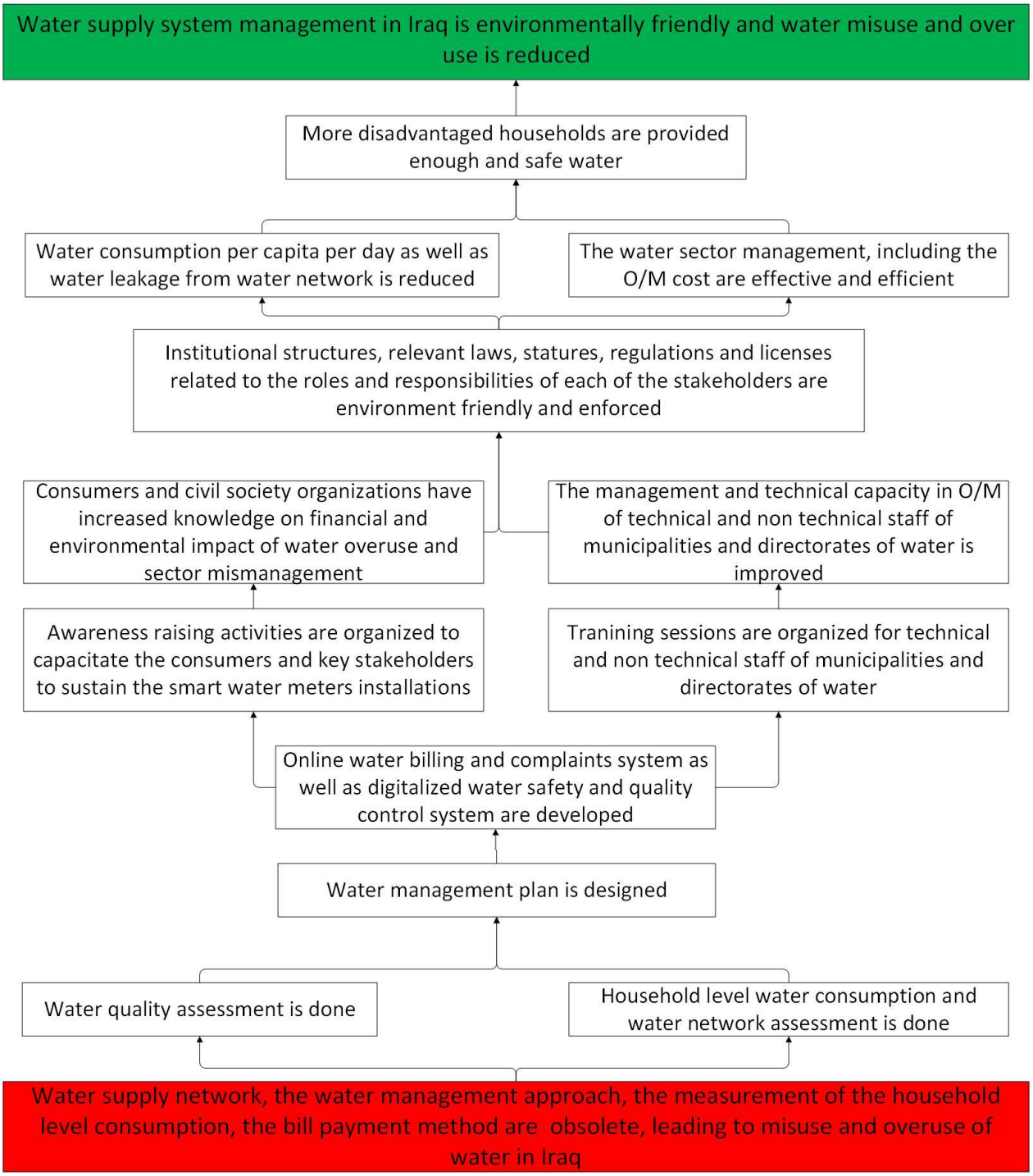


Figure 1: The theory of change of the smart city initiative

ANNEX 2. EVALUATION MATRIX

Note: Some of the questions I the evaluation TOR have been modified, as agreed at inception.

Evaluation Question	Related Questions	Sources of Information	Assumptions
Relevance			
1. To what extent are the Smart City Initiative objectives and activities tailored to the needs and capabilities of consumers and stakeholders, including the Ministry of Municipalities, Mayoralty of Baghdad and service providers?	How were consumer and stakeholder needs identified at the planning stage? What were SCI objectives and activities over the course of the pilot?	Review of SCI documentation KIIs with UNICEF and institutional stakeholders Consultation with consumers in pilot location	UNICEF can confirm the objectives and operational strategy of the SCI, even if there is no programme document or results framework.
2. Is it in line with the comparative advantage of UNICEF?	What is UNICEF's comparative advantage in the WASH sector in Iraq?	KIIs with UNICEF, service providers and (if possible) other international development agencies supporting the scaling up of smart meters and/or online billing in Iraq. (Potentially World Bank and UN-Habitat).	
Effectiveness			
3. To what extent has the Smart Cities Initiative facilitated ~~increased access to quality water and~~ better management of the water service for its target population?~~, particularly disadvantaged and vulnerable population groups?~~	How effective were water management practices at baseline in the pilot area? Were there poor or vulnerable people in the pilot area? If so, how did water management practices change to meet their needs? If the pilot did not target any poor or vulnerable households, could smart meters potentially be beneficial to them in future?	KIIs with UNICEF, the service provider and selected households in the pilot area. Review of service delivery data for the pilot area, and details of any changes in management practices, for the period under review.	Poor and vulnerable groups were not included in the Al Mansour pilot, which targeted 140-150 high-income households. SCI could potentially help to address equity issues in the longer term if unaccounted for water and per capita consumption is reduced city-wide, as this could enable all citizens to access an adequate supply.
4. To what extent are the Smart Cities Initiative's monitoring and reporting mechanisms able to accurately capture initiative results, and is action taken in response to the findings?	What monitoring framework and processes were adopted for the pilot? How was progress reported? How did monitoring data inform planning and decision making?	Review of SCI monitoring reports. KIIs with UNICEF and the service provider.	Bills and consumption data are available for the period under review because online billing began in 2016, one year before the pilot started (this cannot be confirmed yet, at the end of the inception phase and will need further exploration during the data collection).
5. To what extent has to the programme led to water saving?	What were the start and end dates of the pilot? Among the 250 households targeted, what was typical	Comparison of baseline and endline data on household water consumption and	Data are available on domestic water consumption and system losses in the pilot area, over

	daily/monthly water consumption at baseline and endline? Beyond household level, was anything done to reduce system losses in the pilot area?	unaccounted for water in the pilot area. KIIs with UNICEF, the service provider and a sample of consumers.	the course of the pilot (this cannot be confirmed yet, at the end of the inception phase and will need further exploration during the data collection). .
Efficiency			
6. To what extent does the Smart City Initiative use its resources in a way that allows for cost monitoring and maximum achievement per dollar of investment?	How were SCI funds deployed? How were the monitoring of activities and expenditure linked?	KII with UNICEF project management Review of SCI activity and expenditure reports.	Project expenditure data and details of associated monitoring processes will be shared with the team (this will be explored during the data collection, as this was not a priority for the inception phase).
7. To what extent is the initiative's structure (particularly with regards to human resources, cost driver management, monitoring systems) fit for purpose, ~~particularly as compared to the alternative water metering systems~~?	What human resources (UNICEF, contractors and government partners) were deployed for the pilot? Who monitored, and was there close alignment of objectives and the indicators tracked?	Review of SCI plans and reports KIIs with UNICEF project management	
Impact			
8. To what extent has the Smart City Initiative generated significant positive and negative, higher-level effects, both intended and unintended?	What are the perceptions of government stakeholders on project achievements? Since the pilot began, have there been any significant changes at city level in the delivery or management of water supply services?	Desk review of relevant data and documentation from UNICEF and the service provider. KIIs with UNICEF, MOB, service provider and a sample of households with smart meters.	
9. To what extent have the project's effects contributed (or not) to more equitable access to water services in Baghdad?	In what ways is there inequity in water supply in Baghdad? How did equity considerations inform project design? Since the pilot began, have there been any initiatives to improve equity?	KIIs with UNICEF, MOB, the service provider and a sample of consumers from the pilot area.	
Sustainability			
10. To what extent did capacity building approaches prepare technical staff, municipalities, the directorate of water and	Who is responsible for maintaining the network including meters? How were their capacity building needs identified?	Review of reports on capacity building activities under the pilot.	

policy makers to continue maintaining infrastructure established as part of the project (i.e. smart meters, water network)?	What support was provided, and to whom? How do recipients perceive its benefits? Have maintenance practices changed following the pilot?	KIIs with UNICEF, MOB and the service provider.	
11. Which aspects of the services provided by the project are likely to be replicable / not replicable in other Iraqi cities and why?	In other Iraqi cities: Are water supply challenges similar? Are institutional arrangements and capacity for service delivery similar? Are there other basic needs to address before smart meters and online billing become a priority? Can smart meters offer benefits to low- and middle-income households?	KIIs with UNICEF, MOB and the service provider. KII with Ministry of Municipalities (for Kirkuk) Possible visit to Kirkuk (TBC); otherwise remote interviews.	
Synergies			
12. How effective was partner coordination in the Smart City Initiative? 13. In what ways were different stakeholders' efforts coordinated and complementary (or not)?	(These questions are very similar). How were partner roles and responsibilities defined? What co-ordination mechanisms were adopted, including mechanisms for joint learning?	KIIs with UNICEF, Mayoralty of Baghdad, Ministry of Municipalities and service providers.	
Gender			
14. To what extent has this initiative's design and monitoring taken gender into consideration?	Considering the technological focus of the pilot, what were the gender-related issues and challenges?	Review of SCI design and reports KIIs with UNICEF and the service provider	The SCI objectives and scope were well defined and known to stakeholders, even if not documented. (this will be explored during the data collection, as this was not a priority for the inception phase).

ANNEX 3. HOUSEHOLD SURVEY FINDINGS

Terms of Reference for the evaluation included the following requirement:

"The evaluation team will also perform a sample survey of households who have been provided with smart water meters…. in the Al Mansour quarter. The survey will investigate the ratio of the smart water meters that are functional, the profile of household beneficiaries (number, revenue, level of education of household members), household consumption level and household satisfaction with the online billing and complaints feedback mechanism. The evaluation team will generate a sample for the household survey with the WASH Section's support. Additional survey questions will examine household experience with the smart water meters from a gender and human rights perspective. Survey data will be disaggregated by gender."

During inception it was agreed that the scope of the survey would be revised to address a number of issues relating to the points underlined.

1. The pilot deliberately targeted a high-income neighbourhood and there was no need to prove this by asking respondents about their income or education level. Furthermore, households did not choose to participate in the project; the meters were simply installed, free of any charge to the user. A detailed household profile would not, therefore, reveal anything useful about demand for smart meters or their usefulness.

2. Respondents would not know how much water their household consumed and might not know whether their bills had gone up or down since 2017. The survey therefore asked whether respondents *thought* that their consumption and bills had gone up or down. (Data on actual consumption was obtained from the service provider, though this only revealed total consumption for the 149 properties; no household-specific examples were shared.

3. At household level, the pilot installed smart meters in high-income households with a plentiful and cheap water supply accessed via a private tap. Given this context, it was not possible to identify any relevant gender- or human rights-related questions.

4. There was no online complaints system, so questions could not be asked about it. Instead, respondents were asked if they knew what process to follow if they had a complaint.

Survey purpose and scope

In light of the point above, the main purpose of the survey was to find out:

- Whether, and in what ways, respondents had found their smart meter to be useful, compared to previous arrangements
- Whether it had motivated the household to moderate their water use
- Whether respondents thought their water consumption and bills had gone up or down since the smart meter was installed
- Whether, and in what ways, they thought that the quality of service had improved since smart meter installation
- Whether the water supply was considered drinkable, and whether/how it was treated at household level.
- How they would make a complaint, if they had one
- Whether the online billing system was working effectively. (Prior to the survey the consultants were aware that there was no online complaints system, but were under the impression that online billing had been introduced in 2016. This assumption was stated clearly in the inception report and related discussions with UNICEF but not corrected by UNICEF. It only became apparent once the survey began.)

Sampling protocol

Key considerations here were that:

- The TOR did not require a statistically representative sample.
- There was a time constraint on field work due to a partial daytime curfew.
- Smart meters were installed in properties along two main pipelines in Al Mansour quarter, so locating beneficiary households was straightforward.

It was agreed with UNICEF to randomise the sampling by interviewing every third household from the population that received smart meters. In the event, a total of 55 respondents were interviewed, just over one third of the total of 149. The subsequent qualitative analysis was sufficient to provide a useful 'snapshot' of what the pilot has achieved from the customers' perspective.

Given that the survey took place during normal working hours when many people would be of the house, it was agreed to interview any available adult from the household. In the event, the majority of respondents were older people, many of them female.

Survey personnel

The survey team comprised two national consultants, one male and one female. To facilitate introductions and reassure respondents that the survey was official, they were accompanied by a BWD technician. This person did not participate in the interviews, however.

The survey questionnaire with collated responses is presented overleaf. Note that the names and addresses of respondents were recorded only to enable the team to match responses with actual billing data from BWD, though in the event no household consumption data were shared with the team.

Survey questionnaire and collated responses

Survey No.		Date	
Address		Householder Name	
		Years lived at this address	

A: SATISFACTION WITH THE WATER SUPPLY SERVICE			
1. Are you satisfied with the public water supply in terms of:			
a) Reliability and hours of supply		Y 71%	N 29%
If not, why?	Have to use motor: 16 (includes some who said yes) Supply runs for few hours: 2 Low supply: 2		
b) Pressure		Y 58%	N 42%
If not, why?			
Maintenance and repairs		Y 62%	N 38%
If not, why?	Do it ourselves with our own money: 9		
2. Do you do treat tap water before drinking? N/A: 4%		Y 87%	N 9%
If yes, how do you treat it?			
Filter	90%		
Boiling			
Other (specify)	Bottled water: 56%		
3. Do you have any other concerns with the water supply? N/A 2%		Y 11%	N 87%
If yes, what are they?	Water sometimes has odour: 1		
4. Has the quality of service changed at all in the last 4-5 years?	Not sure 18%	Y 7%	N 75%
If yes, in what way?			
5. Do you know what process to follow if you want to make a complaint about the water service?		Y 85%	N 15%
If yes, please give details.	Go to Water Department: 85%		
B: METERING AND BILLING			
6. Do you have a smart water meter?		Y 100%	N
Is it currently working?	Not sure	Y 100%	N
Has it ever broken down before?	Not sure	Y 5%	N 95%
7. Before you got a smart meter, did you already have a water meter?		Y 84%	N 16%
If yes, did the old meter work properly? N/A 16%	Not sure 24%	Y 60%	N

8. Has the smart meter been useful?		Not sure 71%	Y 9%	N 20%
If yes, in what way?	Electronic so should be more accurate: 2 Usage is the same: 6 Improved hours of supply: 1 Already use water carefully: 1 Expensive bill and less water! 1 We take more water: 1			
9. Has the smart meter made you more careful about how much water you use?			Y 51%	N 49%
Why / why not?	Use the same amount as before: 16 No answer: 13 We already use water carefully: 1 Now we have more water, good supply: 2 Because of high cost: 1			
10. Do you think your household water consumption has gone up or down since you got a smart meter?	Gone up 13%	Gone down 13%	About the same 73%	Not sure 1%
11. Do you think your water bills have gone up or down since you got a smart meter?	Gone up 69%	Gone down 2%	About the same 22%	Not sure 7%
12. Is the online billing system working, as far as you know?		Not sure 2%	Y	N 98%
Were there problems in the past?		Not sure	Y	N
If yes, what problems?				

ANNEX 4. LIST OF KEY RESPONDENTS

Name	Position	Organisation
Dr. Ali Al-Khateeb	Chief of WASH	UNICEF ICO
Mr. Ali Auob	WASH Manager	UNICEF ICO
Mr. Hussein Al-Azzawi	WASH Programme Specialist	UNICEF ICO
Mr. Abdoulaye Seye	PME Section / Programme Dept OIC	UNICEF ICO
Ms. Shandana Aurangzeb	Resource Mobilisation Manager	UNICEF ICO
Mr. Hikmat Abdul Majeed	Head of IT Section BWD	Baghdad Water Department, MOB
Mr. Ayad Abdulmajid Hammed	IT Specialist	Baghdad Water Department, MOB
Ms. Jehan Ebrahem	Deputy Directorate Manager	Kirkuk Water Directorate
Mr. Omer Mohammed Salih	Head of IT Department	MOHCPM
Mr. Nafea Mohammed Mofid	Senior WASH Specialist	World Bank

ANNEX 5. INTERVIEWS' GUIDES

Introduction

This guidance had been prepared for the initial stages of the data collection - particularly first interviews with key respondents. Additional respondents, questions and information requests will arise as the evaluation progresses, and the interview guides can be updated accordingly.

The framework for investigation is provided by the evaluation matrix. For each of the evaluation questions (EQs) the matrix provides some additional, more detailed questions and indicates how the question will be answered. The interview guides in this document are based on the evaluation matrix.

The guides

At inception stage, UNICEF identified only a few key respondents, primarily focal persons for the project at the service providers in Baghdad and Kirkuk. We anticipate that further respondents will be identified on the first day of the mission and thereafter - effectively a 'snowballing' approach to data collection. As a minimum, it is likely that principal respondents will include the following:

- UNICEF
  - WASH Chief (for higher level questions on the significance of the pilot and SCI more broadly)
  - WASH officers involved in the design, implementation and technical oversight of the pilot and SCI
  - Staff responsible for financial management and monitoring (since there are EQs on cost-effectiveness)
- Baghdad Water Directorate (under Mayoralty of Baghdad)
  - Focal person for the pilot (Mr. Hikmet). We understand that his role is in accounts rather than technical matters.
  - Engineers/technicians involved in the pilot who can answer questions on the use of smart meters and network management, especially in the pilot location
- Consumers in the pilot area (Al Mansour quarter).
- Ministry of Municipalities, Kirkuk
  - Focal person for the pilot (and possibly others).

Though less essential, we also hope to speak to:

- Other international development agencies working on similar urban water supply initiatives in Iraq. According to the TOR, these include UNDP, UN-Habitat and the World Bank.
- UNICEF's WASH Knowledge Management Specialist, if there is one. (Terms of Reference for this person were included in the documents shared by UNICEF, but there has been no confirmation for his/her presence).

Interview guides for the main respondents are provided on the following pages. Key informant interviews (KIIs) should be semi-structured so that the discussion points are covered but the conversation flows naturally and can move into other relevant areas, depending on what the respondent has to tell us. The exception to this is household interviews, which will use a standard proforma and script.

UNICEF WASH Chief

EQs to explore in this interview

Relevance

1. To what extent are the Smart City Initiative objectives and activities tailored to the needs and capabilities of consumers and stakeholders, including the Ministry of Municipalities, Mayoralty of Baghdad and service providers?

2. Is the SCI in line with the comparative advantage of UNICEF?

Impact

8. To what extent has the Smart City Initiative generated significant positive and negative, higher-level effects, both intended and unintended?

9. To what extent have the project's effects contributed (or not) to more equitable access to water services in Baghdad?

Sustainability

10. To what extent did capacity building approaches prepare technical staff, municipalities, the directorate of water and policy makers to continue maintaining infrastructure established as part of the project (i.e. smart meters, water network)?

11. Which aspects of the services provided by the project are likely to be replicable / not replicable in other Iraqi cities and why?

Synergies

12. How effective was partner co-ordination in the Smart City Initiative?

13. In what ways were different stakeholders' efforts co-ordinated and complementary (or not)?

Discussion points

1. The Smart City Initiative does not have a dedicated project document or results framework. Can you give us an overview of what it is trying to achieve?

- What role did UNICEF play in establishing the online billing and complaints system?
- What have been the most significant achievements and challenges?
- How does the partnership with government operate in practice?
- What future plans are there for the SCI?

2. Before the pilot, did UNICEF Iraq have much experience in urban water supply?

- How does the SCI complement or align with the work of other international agencies?
- What is UNICEF's comparative advantage in the WASH sector in Iraq?

3. Turning to the smart meters pilot project:

- Why was the introduction of smart meters prioritised?
- How was success defined?
- What was UNICEF's role beyond introducing the technology?
- How did the partnership with the Mayoralty / BWD operate in practice?
    - What were the main pilot activities in 2018-19, after the meters were installed?
    - Has there been any TA to the Mayoralty / BWD?
- It seems that the WASH team has not monitored results of the pilot. Why is that?
    - What do you think the pilot has achieved?
    - What is the justification for scaling it up already (there seem to be no documented results)

4. Regarding how the project has contributed to more equitable access to water services in Baghdad:

- With per capita consumption extremely high in the city, what are the equity issues around water?
- In what way has the pilot or SCI engaged with equity issues?

5. Do you think smart meters could be used at scale, including in middle- and low-income areas, within and beyond Baghdad?

- Are water supply challenges similar in other cities in Iraq?

6. What was the motivation for having an evaluation at this stage?

7. Was a Knowledge Management Specialist appointed (we've seen TOR) and if so, what role have they played in the pilot or SCI?

- Has there been any documentation of lessons learned from the SCI?
- Is anything planned?

8. Who else should we be talking to?

UNICEF WASH Admin / Finance Officer

EQs to explore in this interview

Efficiency

6. To what extent does the Smart City Initiative use its resources in a way that allows for cost monitoring and maximum achievement per dollar of investment?

7. To what extent is the initiative's structure (particularly with regards to human resources, cost driver management, monitoring systems) fit for purpose?

Discussion points

1. How were SCI funds deployed?
2. How were the monitoring of activities and expenditure linked?
3. Ask for copies of (or access to) activity and expenditure reports.

UNICEF WASH Specialist(s) overseeing the pilot and SCI

EQs to explore in this interview

Relevance

1. To what extent are the Smart City Initiative objectives and activities tailored to the needs and capabilities of consumers and stakeholders, including the Ministry of Municipalities, Mayoralty of Baghdad and service providers?

2. Is the SCI in line with the comparative advantage of UNICEF?

Effectiveness

3. To what extent has the Smart Cities Initiative facilitated better water management practices for its target population, particularly disadvantaged and vulnerable population groups?

4. To what extent are the Smart Cities Initiative's monitoring and reporting mechanisms able to accurately capture initiative results, and is action taken in response to the findings?

5. To what extent has to the programme led to water saving?

Impact

8. To what extent has the Smart City Initiative generated significant positive and negative, higher-level effects, both intended and unintended?

9. To what extent have the project's effects contributed (or not) to more equitable access to water services in Baghdad?

Sustainability

10. To what extent did capacity building approaches prepare technical staff, municipalities, the directorate of water and policy makers to continue maintaining infrastructure established as part of the project (i.e. smart meters, water network)?

11. Which aspects of the services provided by the project are likely to be replicable / not replicable in other Iraqi cities and why?

Synergies

12. How effective was partner coordination in the Smart City Initiative?

13. In what ways were different stakeholders' efforts co-ordinated and complementary (or not)?

Gender

14. To what extent has this initiative's design and monitoring taken gender into consideration?

Discussion points

1. What issue or problem was the pilot trying to resolve?

- Why was the introduction of smart meters prioritised? (as compared to, for example, tariff reform or reduction in unaccounted for water [UAW]).
- What aspects of network management needed improvement?
- How was success defined for the pilot?

2. Do you think the pilot has been broadly successful?

- What changed as a result of the meters being installed?
- Has network management improved? In what ways?

3. Beyond the installation of smart meters in 2017, what other project activities took place in 2018-19?

- Was any technical assistance provided to the Mayoralty / BWD?
  - The docs shared by UNICEF include TOR for a knowledge management specialist
  - Were capacity building needs identified at the planning stage?

4. EQ 9 asks whether the project has contributed to more equitable access to water services in Baghdad.

- With per capita consumption extremely high in the city, what are the equity issues around water?
- In what way has the pilot or SCI engaged with equity issues?
- Considering the technological focus of the pilot, were there any gender-related issues or challenges?

5. Before the pilot, did the WASH team have much experience in urban water supply including the use of smart meters?

- What has been learned over the course of the pilot?

Possible additional UNICEF informants

- M&E focal person for the pilot (This might be the same WASH Officer that oversees the project)
- WASH Knowledge Management Specialist

Service Provider

Service provider focal person for the pilot (Baghdad)

EQs to explore in this interview

Relevance

1. To what extent are the Smart City Initiative objectives and activities tailored to the needs and capabilities of consumers and stakeholders, including the Ministry of Municipalities, Mayoralty of Baghdad and service providers?

Effectiveness

3. To what extent has the Smart Cities Initiative facilitated better water management practices for its target population, particularly disadvantaged and vulnerable population groups?

4. To what extent are the Smart Cities Initiative's monitoring and reporting mechanisms able to accurately capture initiative results, and is action taken in response to the findings?

Impact

8. To what extent has the Smart City Initiative generated significant positive and negative, higher-level effects, both intended and unintended?

9. To what extent have the project's effects contributed (or not) to more equitable access to water services in Baghdad?

Sustainability

11. Which aspects of the services provided by the project are likely to be replicable / not replicable in other Iraqi cities and why?

Synergies

12. How effective was partner coordination in the Smart City Initiative?

13. In what ways were different stakeholders' efforts coordinated and complementary (or not)?

Discussion points

Pilot project design and implementation

1. What is the background to the pilot - why was it undertaken?

- What were the main challenges with the public water supply?
- What was the objective of the pilot?
- How were BWD involved in its design and planning?
- Why was Al Mansour Quarter selected?
- Was there a good water supply in the pilot location when the project began?

2. Before the project began in mid-2017, was the online billing system already working effectively in the pilot location?

- Were households billed on metered consumption, or was consumption estimated?
- Was the online complaints system already under development?

3. Please explain how the pilot was implemented and the roles played by UNICEF, contractor and BWD.

- Did the project do anything beyond smart meter installation? For example:
  - Improve repairs and maintenance services
  - Reduce unaccounted for water (leakages, illegal connections)

- Improve customer relations
- Introduce measures to help poor or vulnerable customers
- Technical support and training for staff

4. What was monitored and reported over the course of the pilot, and by whom?

Results

5. What was achieved by the pilot?

- Has household water consumption gone down in the pilot households?
  - Can we see the data on this?
- How has billing and revenue from these households changed since the pilot began?
  - Did the tariff change during the pilot?

6. Has the project helped to improve management of the water supply network?

- If so, in what way?
- Have there been any significant changes at city level in the delivery or management of water supply services?

7. What were main challenges in achieving a successful outcome?

8. Has the online billing system operated effectively during the pilot?

9. What type of complaints (if any) have there been from the pilot households?
- Were most complaints easily resolved?
- Can we see records of complaints and action taken?

9. To what extent could the use of smart meters be scaled up within and beyond Baghdad?

- What would be the benefits and challenges?
- Would they be useful for lower-income households?

10. To what extent have the pilot and SCI addressed BWD needs and priorities?

- Is the expansion of smart metering a priority for BWD?
- Are there other issues to address in urban water supply that that are a higher prirority than smart metering and online billing?

Service provider technical personnel (Baghdad)

This would be the people responsible for operation and maintenance of the network in the pilot project location, including smart meters.

EQs to explore in this interview.

Effectiveness

3. To what extent has the Smart Cities Initiative facilitated better water management practices for its target population, particularly disadvantaged and vulnerable population groups?

5. To what extent has to the programme led to water saving?

Sustainability

10. To what extent did capacity building approaches prepare technical staff, municipalities, the directorate of water and policy makers to continue maintaining infrastructure established as part of the project (i.e. smart meters, water network)?

11. Which aspects of the services provided by the project are likely to be replicable / not replicable in other Iraqi cities and why?

Discussion points

1. Have the smart meters functioned well since their introduction?

- If no, what have been the most common problems?
- How good is the new metering system compared to the previous arrangement for assessing consumption and generating bills?

2. How has the introduction of smart meters and an online complaints system helped to improve network management or maintenance?

- Were any repairs or improvements carried out to the network before or during the pilot project? (beginning mid-2017)

3. What training or technical assistance did UNICEF or BWD provide to support the introduction of smart meters?

- Was this useful, and is any further support needed?

4. Has water consumption in the pilot households gone up or down since the introduction of smart meters?

- Can we see the data on this?

5. To what extent could the use of smart meters be scaled up within and beyond Baghdad?

- What would be the benefits and challenges?
- Would they be useful for lower-income households?

Service provider focal person for the pilot (Kirkuk)

EQs to explore in this interview

Effectiveness

3. To what extent has the Smart Cities Initiative facilitated better water management practices for its target population, particularly disadvantaged and vulnerable population groups?

4. To what extent are the Smart Cities Initiative's monitoring and reporting mechanisms able to accurately capture initiative results, and is action taken in response to the findings?

Impact

8. To what extent has the Smart City Initiative generated significant positive and negative, higher-level effects, both intended and unintended?

9. To what extent have the project's effects contributed (or not) to more equitable access to water services in Baghdad?

Sustainability

11. Which aspects of the services provided by the project are likely to be replicable / not replicable in other Iraqi cities and why?

Synergies

12. How effective was partner coordination in the Smart City Initiative?

13. In what ways were different stakeholders' efforts coordinated and complementary (or not)?

Discussion points

Pilot project design and implementation

1. What is the background to the pilot - why was it undertaken?

- How were *[service provider name]* involved in its design and planning?
- What was the objective of the pilot?
- How was the pilot location selected?
  - Was this a high-, middle- or low-income neighbourhood?

2. Before the project began in mid-2017, was an online billing system already operational in the pilot location?

- If yes, were households billed on metered consumption, or was consumption estimated?
  - Was an online complaints system also in place?
- If no, was online billing san complaints introduced during the pilot?
  - When?

3. Please explain how the pilot was implemented and the roles played by UNICEF, contractor and service provide

- Did the project do anything else beyond smart meter installation? For example:
  - Improve repairs and maintenance services
  - Reduce unaccounted for water (leakages, illegal connections)
  - Improve customer relations
  - Introduce measures to help poor or vulnerable customers

4. What was monitored and reported over the course of the pilot, and by whom?

Results

5. What was achieved by the pilot?

- Was the introduction of smart meters relevant and appropriate for Kirkuk?
- Has household water consumption gone down in the pilot households?
- How has billing and revenue from these households changed since the pilot began?
  - Did the tariff change during the pilot?
- Can we see the data on changes in consumption and billing over the project period?

6. Has the project helped to improve management of the water supply network?

- If so, in what way?

7. What were main challenges in achieving a successful outcome?

- Were there other important challenges in urban water supply that the pilot could not resolve?

8. Has the online billing system operated effectively during the pilot?

9. What type of complaints (if any) were received from the pilot households?
- Were most complaints easily resolved?
- Can we see records of complaints and action taken?

10. To what extent could the use of smart meters be scaled up?

- What would be the benefits and challenges?
- Would they be useful for lower-income households?

Service provider technical personnel (Kirkuk)

This would be the people responsible for operation and maintenance of the network in the pilot project location, including smart meters.

EQs to explore in this interview.

Effectiveness

3. To what extent has the Smart Cities Initiative facilitated better water management practices for its target population, particularly disadvantaged and vulnerable population groups?

5. To what extent has to the programme led to water saving?

Sustainability

10. To what extent did capacity building approaches prepare technical staff, municipalities, the directorate of water and policy makers to continue maintaining infrastructure established as part of the project (i.e. smart meters, water network)?

11. Which aspects of the services provided by the project are likely to be replicable / not replicable in other Iraqi cities and why?

Discussion points

1. Was the network providing a good and reliable water supply in the pilot location before the smart meters were installed?

2. Have the smart meters functioned well since their introduction?

- If no, what have been the most common problems?
- How good is the new metering system compared to the previous arrangement for assessing consumption and generating bills?

3. Apart from installing smart meters, were any repairs or improvements caried out to the network before or during the pilot project? (beginning mid-2017)

4. Has the introduction of smart meters and an online complaints system led to any changes in network management or maintenance?

- Can you give examples?

5. What training or technical assistance did UNICEF or BWD provide to support the introduction of smart meters?

- Was this useful, and is any further support needed?

6. Has water consumption in the pilot households gone up or down since the introduction of smart meters?

- Can we see the data on this?

7. To what extent could the use of smart meters be scaled up?

- What would be the benefits and challenges?
- Would they be useful for lower-income households?

Domestic smart meter users in pilot location

EQs to explore in this interview.

Effectiveness

3. To what extent has the Smart Cities Initiative facilitated better water management practices for its target population, particularly disadvantaged and vulnerable population groups?

5. To what extent has to the programme led to water saving?

Impact

6. To what extent have the project's effects contributed (or not) to more equitable access to water services in Baghdad?

Sustainability

11. Which aspects of the services provided by the project are likely to be replicable / not replicable in other Iraqi cities and why?

[See household questionnaire]

Other international development agencies supporting similar initiatives (within or beyond Baghdad)

EQs to explore in this interview.

Relevance

1. To what extent are the Smart City Initiative objectives and activities tailored to the needs and capabilities of consumers and stakeholders, including the Ministry of Municipalities, Mayoralty of Baghdad and service providers?

2. Is [the SCI] in line with the comparative advantage of UNICEF?

Impact

8. To what extent has the Smart City Initiative generated significant positive and negative, higher-level effects, both intended and unintended?

9. To what extent have the project's effects contributed (or not) to more equitable access to water services in Baghdad?

Sustainability

11. Which aspects of the services provided by the project are likely to be replicable / not replicable in other Iraqi cities and why?

Discussion points

1. How is your organisation involved in urban water supply in Baghdad or elsewhere in Iraq?

- What specifically are you supporting or trying to achieve?
- Are you involved in the introduction of smart meters?
- How does your partnership with BWD / other service providers operate?
- What have been the achievements and challenges so far?

2. Are you familiar with UNICEF's smart metering pilots in Baghdad and Kirkuk, and the Smart City Initiative?

- Are there any overlaps or synergies between your organisation's work and UNICEF's?
  - Is there a sector working group (or similar) that both organisations belong to?
- How have UNICEF's smart metering pilot, or the Smart City Initiative in general, contributed to the improvement of urban water supply services in Iraq?
- Do you think that it would be viable and useful to scale-up the use of domestic smart meters within and beyond Baghdad?
  - Why / why not?
  - To what extent can the use of smart meters help to improve equity of access to an adequate, safe and reliable water supply?

ANNEX 6. LIST OF PRINCIPAL DOCUMENTS REVIEWED

UNICEF/UN-Habitat (2011) Iraq - Public Sector Modernization Program, Functional Review report, Water and Sanitation Sector.

UNICEF/UN-Habitat (2011) Iraq - Public Sector Modernization Program, Service Delivery Report, Water and Sanitation Sector.

UNICEF/UN-Habitat (2011) Iraq - Public Sector Modernization Program, Costing Study Report and Medium Term Expenditure Framework.

UNICEF/UN-Habitat (2011) Iraq - Public Sector Modernization Program, Road Map to Modernization, Water and Sanitation Sector.

UNICEF Country Programme Document, Iraq (2016-2019)

UNICEF (2017). Public Awareness Creation on Efficient Water Use and Improved Hygiene Practices in Iraq. Final Report to European Commission.

ICO Strategy Note - WASH 14 Dec 2017

WASH Program Strategic Note. ICO WASH Program. 12th Nov. 2018

WASH Program Strategic Note. ICO WASH Program. April 2019

WASH Programme Strategic Note: Priorities and Way forward for 2021 (Draft)

UNICEF Rolling Workplan Matrix 2016-17

UNICEF Rolling Workplan Matrix 2018-2019 - WASH SECTION

2019 UNICEF COAR

'PF4C case studies' (undated)

UNICEF Country Programme Document, Iraq (2020-2024)

Note: a number of additional documents were shared by UNICEF but were less directly relevant to the evaluation.

ANNEX 7. ETHICAL CLEARANCE

Attached to the PDF version of the report