

JUNE 2021

# EMBRACING TECHNOLOGY FOR IMPROVED WATER SERVICE DELIVERY IN KENYA

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TECHNOLOGY ADOPTION AND WATER SERVICE  
PROVISION: CASE STUDY OF GIS, ERP AND BILLING  
SYSTEMS IN NAWASCO

**CASE STUDY**  
JUNE 2021



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For more information on this report or Kenya Markets Trust, please get in touch:

Kenya Markets Trust,  
14 Riverside Drive, Cavendish Block,  
2nd Floor, Suite B,  
P.O. Box 44817 – 00100,  
Nairobi, Kenya  
Tel: +254 20 2588343  
+254 722 201233  
Email: [info@kenyamarkets.org](mailto:info@kenyamarkets.org)

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With regards to our proven results over the years, KMT has produced this case study referencing the work done in the water sector, specifically the case study has borrowed significantly from information generated by Nanyuki Water and Sewerage Company (NAWASCO). KMT facilitated the utility to procure and implement an ERP system that has since been adopted holistically.

## Authors

**Pauline Nguni**  
*Results and Evaluation Specialist*

**Patrick Omondi**  
*Water Sector Intervention Specialist*

**Alex Kandie**  
*Communication Specialist*



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# Introduction

Water utilities in Kenya lack hard evidence and data systems of their operation for effective management and decision-making. This deficiency greatly contradicts the reporting on the progressive realization of the right to water for millions of people living in Kenya. As a result, poor quality of water services is rendered to the population at a high cost, while making the water utilities less economically-efficient and operationally unsustainable in service provision.

Information Management Information Systems (IMIS) and Enterprise Resource Planning (ERP) remains a weak area for many water utilities. The adoption of such technologies will ensure transparency in operational functions and compliance to set organizational systems.

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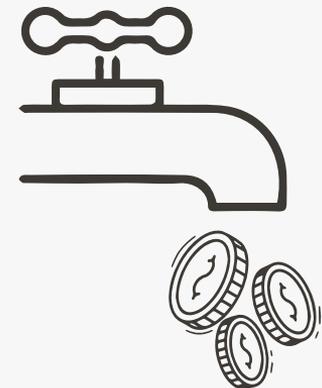
Over the last eight years, Kenya Markets Trust (KMT) has facilitated water services transformation agenda in Kenya working with key sector institutions such as the Water Services Regulatory Board (WASREB), Water Sector Trust Fund (WSTF), Water Services Providers Association (WASPA), as well as individual water service providers (WSPs).

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To transform the water service delivery into a functional, efficient, and effective market, KMT has been working with eight urban water companies and five rural water utilities to enhance better operational efficiency through product and process innovation; deepen better and improved utility and sector governance; accelerate adoption and uptake of financing instruments; and promote professionalization of rural water services.

Through these efforts, **103,971 new households** have access to clean and safe drinking water.

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**103,971**

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# Background Information

In 2018, KMT in partnership with SNV conducted an audit of non-revenue water (NRW) (through Atkins consultant 2018) in nine urban water utilities. This audit exposed glaring gaps that existed in customer engagement and operations sections of the utilities. It is worth noting that, NRW is one of the operational sustainability indicators for WSPs thus a higher NRW means a WSP whose commercial and financial viability is low thus a threat to its future existence and continuity. A low NRW on the other hand, indicates a good credit rating, strengthened and improved efficiency of the given WSP.

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Some of the pertinent gaps that were identified included, lack of platforms to provide feedback to the customers and absence of efficient means to manage and support billing functions of reading customers' water meters, billing them for water consumed, and collecting revenue from the provided service.

One of the utilities that was audited was Nanyuki Water and Sewerage Company (NAWASCO) in Laikipia County. Based on the findings of this audit, KMT and NAWASCO jointly assessed the need and decided to adopt the use of relevant technology to aid the water utility to improve its efficiency.

Therefore, this case study focuses on how technology has improved utility operational and performance efficiency with respect to: NRW management; customer complaints management; process efficiency at various utility departmental levels; staff productivity; improvement governance with respect to standards and transparency; utility strategies on the systems moving forward, among others.

**This audit exposed glaring gaps that existed in customer engagement and operations sections of the utilities**



# Journey to digitalization

In the recent years, data and digitization have proven to be critical game changers in services delivery across various industries. In fact, to ensure effective, economic and efficient service provision, decision making must be data-driven. Collection and analysis of operational data can be accurately done using various technological systems.

In 2019, NAWASCO's management agreed to roll-out the following systems.

**01** **First**, the facility was supported to acquire and implement a robust Enterprise Resource Planning (ERP) software. This is an independent software that integrated company functions into one platform. Previously, each department had independent solutions which made it difficult to follow processes across departments and for quick decision making.

Subsequently, some risks have been reduced since initially the company relied on softwares developed by staff, whereby in the absence of the said staff the company was held hostage and could not trouble shoot any system challenges.

**02** **Secondly**, NAWASCO, in partnership with KMT, identified a gap in the manual method employed in asset management. This opened an opportunity for loss of the company's assets.

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For a long time, NAWASCO's field officers were either using very old existing maps, or in most cases, no maps for Operations and maintenance of the water service provision. Having inherited customers from the Nanyuki Municipal council during the establishment of NAWASCO, there was quite a lot that the company had to do to manually develop an inventory of the existing assets to update the few old maps that were in existence. This included developing maps of water pipeline distribution, intake point and the consumption points. That was cumbersome! With advancement in technology, a decision was made to digitize the system to ease the identification burden and GIS was introduced.

*James GPS Officer NAWASCO*

Under this partnership, digitization of systems and assets commenced, and old maps were converted into computer-readable documents that were used to develop the Geographic Information System (GIS). Computer-readable documents for GIS are *shape-files* that represent various water infrastructure systems (i.e. pipeline, tanks, bore, meters etc) into a digital map inform of symbols; lines,dots,triangle etc. The shape files have location details of each of the customers, infrastructure and its characteristics i.e. size, nature, status etc thus providing simple but complex method of storing asset information for ease of management.

This technology is an effective tool for storing, managing, and displaying spatial/geographic data often used in water

resources management. It is used to query data, reduce redundant record keeping, and provide quick analysis to help staff make better and more informed decisions.

03

Finally, to institutionalize this initiative for sustainability, KMT supported NAWASCO to establish a dedicated GIS department that establishes and anchors a foundation for geospatial information management on its entire water and sewer collection, supply systems and treatment.

According to Mr. James Njenga, NAWASCO's GIS Officer, the water utility acquired one Global Positioning System (GPS) device to capture the water lines and clients served. However, this was not sufficient to serve the needs of the utility.

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In 2019, Kenya Markets Trust procured three Garmin GPS devices to assist us in mapping our customers. This was crucial in improving the data collection speed that in turn hastened the development of the GIS tool that guided in the demarcation our customers served by different water lines and thereby making it easy in reducing the non-revenue water,”

*James explains.*

**Mr James Njenga showcases one of the GPS devices purchased by KMT**



**the water utility acquired  
one Global Positioning  
System (GPS) device to  
capture the water lines  
and clients served**

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# Results (Impact of the technologies on service provision)

## 01. Revenue Collection Efficiency.

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WASREB defines revenue collection efficiency as the total amount of money collected by a utility and expressed as a percentage of the total amount billed over the same period. It has been used to measure the effectiveness of the revenue management system in a utility. Revenue collected, as opposed to amounts billed, is what impacts on a utility's direct ability to fund its operations.

NAWASCO's adoption of a robust system (ERP) has enabled the integration of billing, revenue collection, bank reconciliation and customer communication to the utility.

Before deployment of the ERP, the company used to produce bills based on an average costing strategy. Currently, the system enables each user to be accurately billed based on individual consumption and not estimates. Before the ERP, the facilities' four billing officers were all involved in billing at the same-time. The ERP introduced a sequential process

where only one officer bills while the rest approve the bills at different stages.

Additionally, the system has also led to real-time processing. When a customer pays, data is received in real time, payment can be seen online, and reconciliations are now done real-time. Previously, the company had to wait for customers to come and complain in person with physical evidence of payment. By that time, disconnections had already been done which was inconveniencing and costly to the customers and the company.

Further, the system has enabled the company to minimize errors; the system isolates debt and revenue collection per bloc and advices on the next steps effectively. In addition, during billing, the system has a capability to prompt for missing information, and this minimizes errors during billing, leading to improved efficiency.

Figure 1 **Four Years Revenue Collection Efficiency**

### Four years Revenue Collection Efficiency



Source: NAWASCO Data 2020

Note: ERP was implemented in April 2020



## 02. Integrated systems efficiency

Prior to the adoption of the ERP, NAWASCO had multiple systems that stood alone in silos, resulting in numerous inefficiencies since data from different departments were not linked to one another. The ERP has enabled consolidation of information, allowing decision-makers to see what is happening in different departments and how this affects other related parts of the organisation.

On production, the system is able to determine average production levels, beyond or below which it prompts the technical team for corrective action through color coding, whereby red means exceeded or less production while green means, production is within the production range. This functionality became useful in expediting actions meant to restore production at optimal levels thus eliminating water loss arising from over production or reducing water shortage complaints due to under-production.

Changes have also been felt on billed volume because of real-time monitoring of meter readers. There used to be problems of billing on average as shown in the table below, this has since been addressed by the new system through real time data submission thus allowing tracking, analysis and control of the indicator. The new billing module generates bill on time and exact amount leading to higher customer satisfaction. ERP has enabled meters to be read accurately; the system prompts on under and or over consumption (anomalies will pop-up if they are in the system captured)

**Table 1** Change in billing on average by tariff blocks

Tariff Blocks (m <sup>3</sup> )	Before ERP	After ERP
0-6	3 out 10 were billed on average	1 out 10 connection are average
7-20	6 out 100 connection on average	4 out 100 connection on average
21-50	4 out 100 connection on average	2 out 100 connection on average
51-100	4 out 100 connection on average	3 out 100 connection on average
101-300	4 out 100 connection on average	3 out 100 connection on average
Over 300	1 out of 10 connections	If any 1 out of 10 connection on average

Source; NAWASCO 2020

Considering, billing on average/estimate is not accepted practice by the regulator since it leads to inflated or inaccurate consumer bills, a reduction in average billing therefore is an improvement in billing efficiency.

It is evident that at least in every tariff block, the number of connections billed on estimate has decreased as shown in the above table. With the ERP system, the meter reader has to take pictures, and without pictures, the system will flag off the entry. The meter reading is picture and coordinates based; where-by without photos, the performance of the meter reading drops.

The company has adopted QR codes on meters, QR codes are scanned and uploaded/updated in the system, the meter reader has to scan and feed the details in the system. Meters are installed and coordinates taken; the meter readers can therefore be directed on where the meters are in-case, they are missing.

ERP has introduced automated demand-based water supply; Water demand is determined, supplied and monitored via the technical module. If demand required is 280m<sup>3</sup> per day, the system will flag off under or oversupply thus providing timely information for corrective measures hence reduction in Non-Revenue water. **“There is a game ranch where we used to supply 133.3m<sup>3</sup> per day; the system has based the demand at 50m<sup>3</sup> per day, thus freeing approximately 80m<sup>3</sup>/day to be supplied in needy areas”.**

On financial management, the system has enabled tracking of cost of meters since inventory management has become easier. Further the ERP system is linked with the bank system and assist easy reconciliation, such that if customer deposits payment indicating the correct account number, it is automatically picked at the utility, leading to improved customer care, since a notification is sent once payment is successfully received. Further any amount deposited in the bank and not allocated to any customer account is always picked and flagged to the team for easy follow up. The system is able to monitor WASREB set ratios, for example O&M cost recovery and personnel costs are calculated automatically and it set in such a way that, there will always be a notification if these ratios are not being met, this is a great move altogether, as before this was being computed manually.



**There is a game ranch where we used to supply 133.3m<sup>3</sup> per day; the system has based the demand at 50m<sup>3</sup> per day, thus freeing approximately 80m<sup>3</sup>/day to be supplied in needy areas**

Table 2 2020 Billing method variation

Class	Tariff Block	ERP Month	BEFORE				AFTER			
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
C6	0-6	Total billed	7404	7933	8017	7295	7442	8557	9678	9010
		Estimated billing	1302	1746	1979	4077	547	1047	1772	1561
		% on Estimated	18%	22%	25%	56%	7%	12%	18%	17%
C5	7 - 20	Total billed	4737	4842	4694	5155	4802	5126	4941	5221
		Estimated billing	209	304	306	306	40	405	134	167
		% Estimated	4%	6%	7%	6%	1%	8%	3%	3%
C4	21-50	Total billed	1188	1167	1145	1284	2564	1214	1129	1368
		Estimated billing	33	52	54	54	26	78	17	20
		% Estimated	3%	4%	5%	4%	1%	6%	2%	1%
C3	51-100	Total billed	234	231	217	207	224	212	200	251
		Estimated billing	13	8	11	7	1	13	3	7
		% Estimated	6%	3%	5%	3%	0.4%	6%	2%	3%
C2	101-300	Total billed	100	99	82	94	85	75	72	92
		Estimated billing	2	2	4	7	3	7	0	1
		% Estimated	2%	2%	5%	7%	3.5%	9%	0%	1%
<b>Total Connection billed on Estimate</b>			<b>1,559</b>	<b>2,112</b>	<b>2,354</b>	<b>4,451</b>	<b>617</b>	<b>1,550</b>	<b>1,926</b>	<b>1,756</b>
<b>Overall Billed Volume</b>			<b>251,973</b>	<b>217,048</b>	<b>234,946</b>	<b>223,027</b>	<b>278,889</b>	<b>247,901</b>	<b>241,050</b>	<b>257,001</b>

### 03. Quality of services to the customers

Quality of services in relation to strategic customer-utility engagement had tremendously improved by the time data for this case study was collected in November 2020, a 7 months trend (March-October,2020) evidenced a great change and shift. Technology has enabled customer-centric relationship to blossom; customer complaints and resolution mechanism has been enhanced through Customer Relation Module (CRM). Before, NAWASCO had phone applications where meter readers and customers will raise comments/complaints, this system was limited to systems administrators, who would at will cascade complaints to the person/department concerned; ERP has reversed this process, complaints/complements are viewed by all and resolved as scheduled by the respective sections/departments, therefore, customer complaints are monitored effectively and resolved in real time.

Due date for disconnection has been automated and penalties goes to the customer accounts automatically. This has made customers to pay bills before the due date; SMS are sent to customers in advance. USSD has enabled the customers to query and complain online. In the old system, the bills were sent to all; in the ERP one can send to one account and can track those that bounces back. the ERP system is limitless. The ERP has enabled effective feedback; when the SMSs don't get to the customers; the system bounces back. Further the system assist in tracking handling of customers complains, and flag off those still pending.



**Technology has enabled customer-centric relationship to blossom; customer complaints and resolution mechanism has been enhanced through Customer Relation Module (CRM).**

## 04. Staff productivity

Technology through adoption of ERP has transformed the human resources and staff productivity landscape especially in the water sector. Before ERP implementation, staff management was manual, all operations and applications were paper-based and staff were to be physically present and monitored for work to be performed. With ERP in place, this has since been eliminated; the system has enabled online leave application that automatically populates/computes leave days for all staff; further, it was noted that the ERP has made delegation of duties much easier. With self-service platform, all staff are now requesting (including pay-slips) and surrendering imprest in the system, staff appraisal, work-plans and objectives are embedded and tracked in the system; there has been real-time reporting with all staff; customer complaints and resolutions are linked to the ERP; and this accounts for scoring for all staff during performance reviews; there has been positive trends in staff productivity and adoption of technology in service provision. For example, the billing processes are only managed by 1 staff, unlike before where all the three staff would do billing manually, otherwise

the other 2 staff take up the role of approvers, this leads to seamless process and quality delivery from the staff. Having this system, there is increased fairness and trust among the utility staff, since all actions can be tracked and accessed in the system. This boosts staff morale and production levels.

The ERP system is cloud based, hence for some reasons if a staff is not able to come to the office, they are still able to perform their roles as far as they have access to internet. This has seen the utility improve on turn-around time of various approvals and requests, as nothing stops at any moment.



## 05. Governance (service transparency and improved standards)

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With introduction of the ERP system, there is increased fairness and trust among the utility staff, since all actions can be tracked and accessed in the system. This boosts staff morale and production levels

Caroline Kiongo-HR and Administration Manager, NAWASCO

Since all operations and performance are using real time data. The managing director has a dashboard, that provides a bird's eye view of all the departments and performance at a glance; and decision making is very fast; thus, accelerated decision making. Suppliers are hedged and prioritized in payment of debts; this has made the company to be in good standing with the suppliers. Debtors' payments are done in the system with three levels of approvals. The system has been linked to Family bank for onward transactions; (payments). ERP automatically generates suppliers' statements; this has made suppliers reconciliation easier.

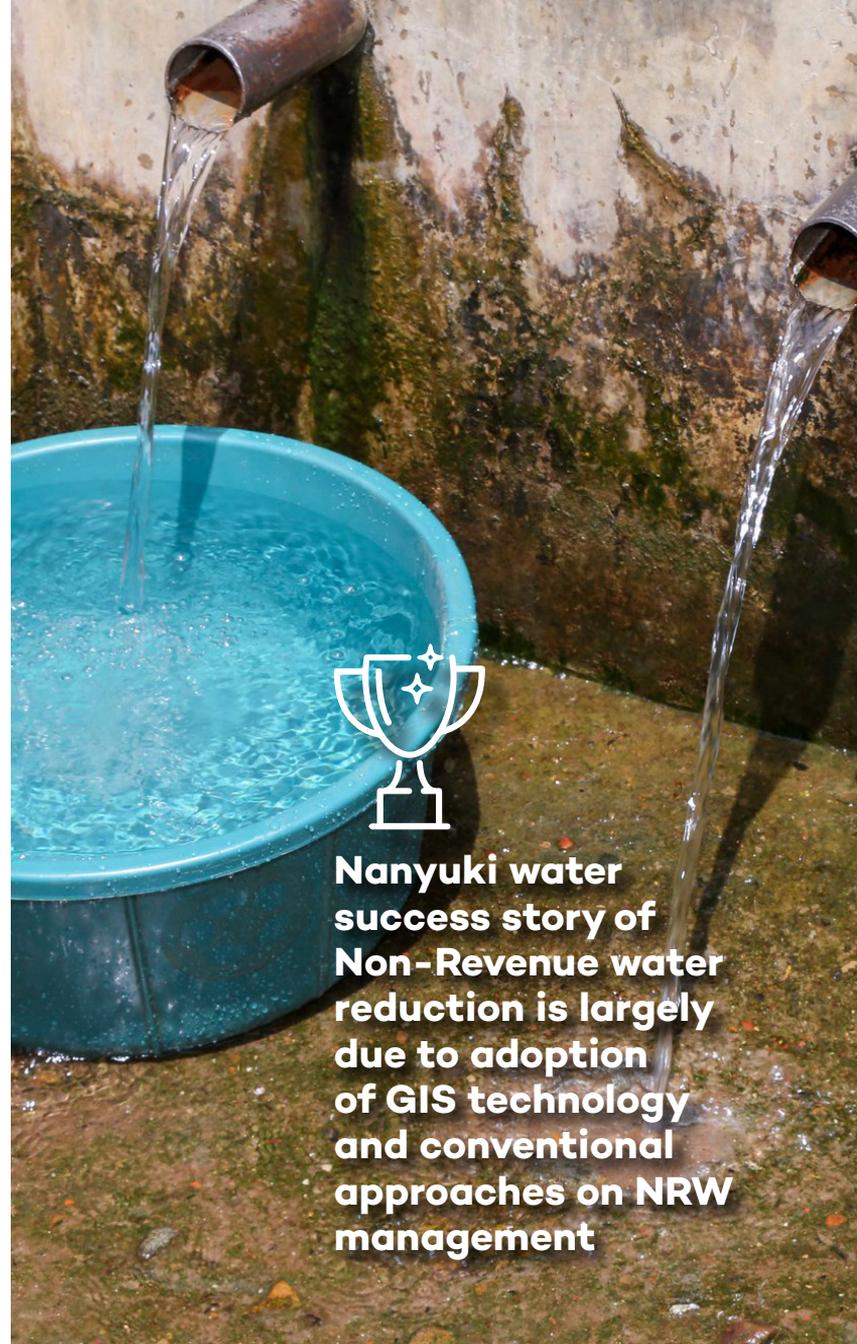
## 06. NRW Management

Nanyuki water success story of Non-Revenue water reduction is largely due to adoption of GIS technology and conventional approaches on NRW management. The successful actions performed in the company were a blend of different actions/activities as outlines in the NRW reduction roadmap that was developed by the association Industry WASPA for national utilization.

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One of the first action adopted is to utilize GIS in DMA management whereby customer are well isolated in any given/defined area. Apart from just having the customers' accounts in the billing database, there is also need to know their physical location in the pilot/sub-DMA areas within the main isolated DMA's. This is useful in differentiating between metered, unmetered, disconnected, unregistered customers and their consumption in relation to zonal meters.

With the introduction of the ERP system, the utility is able to offer demand-based supply, whereby they are able to monitor agreed production volumes versus supply volumes, if supply goes beyond their targets the system prompts and they adjust the targets accordingly. The fact that billing volumes is on actual as opposed to billing on averages, this has positively impacted the overall utility NRW percentages, before ERP system, the NRW percentages would range between 37%-42%, but as at November 2020, the average NRW percentage range is between 36%-40%.



**Nanyuki water success story of Non-Revenue water reduction is largely due to adoption of GIS technology and conventional approaches on NRW management**



## Lessons learned

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- »»» NRW related issues are not governance issues, this has been tested and is positively true through the ERP and data on real time will change scenarios when it comes to NRW management. This means that NRW is more of an operation issue and a simple investment in a system comes in handy to solve these. This can be validated under the WASREB governance assessment Matrix, where lack of information system is considered a governance issue and can impact NRW negatively through inaccurate information.
- »»» Data driven decision making on leaks and bursts management is made easier; pictures and coordinates are taken and loaded in the ERP for evidence and the meter readers use real time data as well and submitted to the billing officers.
- »»» Technology can improve efficiency of water utilities. Leads to reduced workload on staff, while automating many manual activities.
- »»» Better systems lead to relevant, timely and cost-effective services to water users
- »»» GIS and detection of leaks and bursts leading to quick resolution and little water loss?

## Conclusion

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Technology is a key driver to development, evidence from NAWASCO demonstrates that technology can in reality improve service delivery to customers. Some challenges that have been linked to poor governance, evidence from these results, has shown that for instance NRW is a governance issue, and an administration issue that can be solved by employing the right systems. Customer's satisfaction is at the heart of any utility, this can be fulfilled by having the right system and technologies in place.



**Technology is a key driver  
to development**





Better Markets, Better Lives