



Digital enterprise transformation in Water Establishments

Focus on Bekaa Water Establishment (BWE)

DIGITAL TRANSFORMATION ACTION PLAN

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RECIPIENT

Organisation	Name	Position	Date
AFD	JAAFAR Rosana	Sectoral Expert	12/01/23
AFD	SAADE Joanna	Project Manager	12/01/23
AFD	SALIBA Ramy	Project Manager	12/01/23
BWE	Jean Gebran	General Director (interim)	12/01/23

VERSIONS

n°	Date	Comments	Author	Verified	Approved
1	December 2023	Initial Diagnostic	L. Bargheon	V. Soulard	F.Lacour
2	January 26th 2024	Digital Transformation (10-year) Action Plan - Final Report	L. Bargheon	V. Soulard	F.Lacour

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ACRONYMS

AFD	Agence Française de Développement (French Development Agency)
AG	Above Ground
AMI/AMR	Advanced Metering Infrastructure/Automatic Meter Reading
BMLWE / EBML	Beirut Mount Lebanon Water Establishment / Eaux de Beyrouth et du Mont-Liban
BWE	Bekaa Water Establishment
CAPEX	Capital expenses
CD	Compact disc
CMMS	Computerised maintenance management system
CRM	Customer Relation Management
DMA	District Meter Area
DMS	Document Management System
DSP	Data Service Provider
EAM	Enterprise Asset Management
ERP	Enterprise Resource Planning
EXCOM	Executive committee
GIS	Geographic Information System
HR	Human Resource
HSE	Health, Safety, and Environment
IFI	International Financial Institutions
IT	Information technology
LAN	Local Area Network
LIMS	Laboratory information management system
MIS	Management of Information System
MoU	Memorandum of Understanding
NRW	Non-Revenue Water

NLWE	North Lebanon Water Establishment
O&M	Operation & Maintenance
OPEX	Operating expenses
PLC	Programmable Logic Controller
QMS	Quality Management System
SCADA	Supervisory Control and Data Acquisition
SDC	Swiss Development Corporation
SOP	Standard Operating Procedure
SWOT	Strengths, Weaknesses, Opportunities, and Threats
UG	Under Ground
VM	Virtual Machine
WAN	Wide Area Network
WE	Water Establishment
WWTP	WasteWater Treatment Plant

EXECUTIVE SUMMARY

AFD is implementing a program entitled "Technical assistance program to support reforms in Lebanon's water and sanitation sector" which aims to strengthen water and sanitation management capacities in Lebanon, including Bekaa Establishment (BWE) - 451 employees providing water to 91 000 customers, with a total turnover collection of 72,342 MLBP (48 M\$) in 2022. This document presents the outcomes of the **Diagnosis & Digital Maturity Assessment** carried out for the BWE in September 2023:

- It provides a detailed digital maturity diagnostic per business process. It highlights the key strengths and weaknesses, summarised in a SWOT.
- It suggests high level areas for improvement, that will be detailed in a second chapter produced as a second step.



OVERALL STRENGTHS AND WEAKNESSES OF BWE REGARDING DIGITALISATION

As main findings, the diagnosis showed:

- Despite the **absence of a governance or strategic vision on digital**, IT projects are in progress. However the **project management processes are not formalised** and sometime non existent preventing some projects from progressing. The problem isn't so much programming and configuring the tools, but rather change management and training.
- The BWE relies on a **strong ERP**. Customer, Finance and Administration departments are embarking on their digital transformation journey with the help of this ERP system. As for the Operations and Maintenance department, it must take advantage of the **SCADA implementation currently underway** and adapt its processes to make the most of it.
- The water establishment benefits from the **strong support from NGOs** (USAID, UNICEF), not only on the ERP development, but also by financing hardware in the HR and customer service area (Hand punch for worker time control, tablets for the CRP1 project). However, **financial stress prevents BWE from renewing digital tools licence** by its own especially on the Customer department side with the impossibility to publish the website (CRP2).

Strengths	Weaknesses
<ul style="list-style-type: none"> ● Dedicated modules in the ERP for the customer, finance, procurement and HR; ● The current version of the ERP includes a document control module; ● Relevant overall infrastructure; ● Existing SCADA system, managed by a motivated team (despite a lack of knowledge in automation) allows 30% of the installations to be operated remotely and will be progressively extended to eventually control all of BWE's installations; ● Traceability culture regarding the water quality management (regular reporting); ● Existing GIS, but there is a need to improve the way information (new installation or network) is transmitted; ● Ongoing website development. 	<ul style="list-style-type: none"> ● Lack of IT master plan; ● Centralisation of IT service making the user support difficult; ● No regular reports are requested from management; ● Lack of overall documentation (training, user manual...); ● Undersized hardware for ERP use; ● Few skills in automation available in the Establishment. ● The lack of projects leads to a decrease in motivation and a lack of challenge for the teams in terms of methods and processes. ● Employees have become accustomed to using other tools to compensate for ERP gaps; ● Willingness to keep paper (for subscription, invoice, etc).
Opportunities	Threats
<ul style="list-style-type: none"> ● Strong financial contribution of USAID (software, licences, hardware, training...). 	<ul style="list-style-type: none"> ● All licences, maintenance & support fees are in USD and hard to handle due to the economic crisis and LBP inflation (WAN connection, mobile app subscription, web development and hosting, UPS maintenance, photocopier maintenance...); ● Remote access to Main SCADA (cybersecurity threat).

Table 1: BWE overall SWOT



FOCUS ON SCADA ASSESSMENT

SCADA equipment for BWE has been developed partly across the water establishment. An audit conducted on site permitted to categorise the facilities into two categories:

- Plants part of BWE Main SCADA: these sites are equipped following common specifications, with consistency in the equipment used between sites. This implementation is conducted in two phase implementation by an external contractor, addressing 64 sites among around 150 sites of the establishment (~30%). We are currently in the second phase.
- Plants with local SCADA equipment: these sites were implemented following their own local strategy. Therefore it is expected to find inconsistencies between facilities. Some supervisions are available locally in the form of control panels with LED displays. Also it has been observed that some instrumentation and control equipment were missing or degraded on these sites.

After analysing existing elements, Seureca sees the existing organisation and methods as a very good base to extend the SCADA. The following topics are the main axis to address for further development:

- Implement technical corrections and enhancement on the existing SCADA in order to scale it to whole water establishment;
- Define and implement a SCADA operational strategy;
- Define and implement a Strategy to securise skills in the water establishment;
- Define and implement measures against cyber attacks and vandalism.



DIGITAL MATURITY ASSESSMENT OF BWE AND IDENTIFIED TARGET STATES

The diagnostic phase leads to a **digital maturity grid** presenting the current digital maturity levels and a **target state** that SEURECA proposes to achieve at mid and long term.

It is important to remember that **digital technology must be at the service of the business**, so it is **necessary to tailor the targeted level of digital maturity to the real needs** of the service and to the key improvements that will enable it to meet its strategic objectives: **to supply water in sufficient quality and quantity to users**, and to be **self-sustainable**.

On this basis, the proposed **10-year digital vision for BWE** is as follows:

- A **reliable feedback of operational information from the field**, to improve service quality and financial performance: SCADA volume monitoring, water balance calculation, monitoring of customer payments and debts, etc;
- **Optimised day-to-day operations** to improve their impact on service levels (e.g. works order management system, preventive maintenance in CMMS, digitization of the customer journey, etc.) and reduce time wasted on low value-added actions (digitization of purchase requisitions, HR management, etc.);
- **A top management with a 360° vision of the water establishment** (integration of all information in the ERP, implementation of performance monitoring tools) enabling strategic planning and continuous improvement;
- **An organisation enabling this digital transformation** to be carried out (strengthening of the IT department, development of a digital strategy, etc.).

The ultimate goal is to make BWE a **self-sustaining enterprise** using the digital tools and a modern organisation to ensure efficient processes in the utility. The target state has been suggested taking into consideration this vision.



DIGITAL TRANSFORMATION ROADMAP

Based on the initial assessment and the target state previously defined, a **tailored 5-years action plan** was developed to guide BWE on the various steps to be implemented to pursue its digital transformation journey. The key actions of this strategy are the following:

- **Revision of the current organisation** to create a robust foundation for the WE's digital transformation: Digital strategy drafting, ICT department structuring, SCADA activities strengthening, etc;
- Progressively **expansion of the SCADA on the sites identified**, in line with a Regional SCADA strategy, and **secure skilled internal and external human resource** to operate it. Overcome the current lack of visibility on basic indicators such as production volumes or energy consumption;
- **Implementation of a CMMS** to overcome the current lack of vision on O&M activities;
- **ERP enhancement** (creation of new modules, integration with other business software) to facilitate day-to-day operations and ensure integrated management of information from different business processes (O&M, sales, etc.).
- **Overall improvement of commercial management processes and of the customer experience by strengthening existing digital solutions** (CRM, customer database) and **introducing new ones** (e-payment, debt management dashboard, customer service portal, mobile application for on-the-field customer information update).

The prioritisation of actions and their phasing over time have been designed as follows:

- **Actions that are necessary for BMLWE to reach a "competent" level of digital maturity** - i.e. to ensure a level of service that meets international standards - and those enabling rapid gains are considered to be carried out in the next few years (**2025-2029**).
- **Complementary actions, which should enable performance gains but represent a major investment that is best spread out over time, or are less essential to the efficient day-to-day operation** of the water service, are considered to be carried out as a continuation of the previous actions, during the following years (**2030 - 2034**).

The support of a 2-3 years **technical assistance project** is also highly recommended moving forward to support BWE on different levels and help managing the transition:

- Guidance on initiating the various steps of the strategy;
- Support of international digital experts from the water business while BWE recruits its own experts;
- Knowledge transfer and organised capacity building;
- Support on preparation of technical specification and tendering processes that may be required for the implementation of the various activities;
- Etc.



NECESSARY INVESTMENTS

The implementation of this ambitious transformation roadmap will require external financial support and the resources currently generated by the utility are not sufficient to self-finance the proposed improvements. Hence, SEURECA provided a quick estimate of the budgets related to each of the main initiatives proposed in order to assist BWE in initiating discussions with its financial partners.

The budgets required for the action plan implementation includes:

- **CAPEX** which are mostly consultancies and procurement of hardware;

- **Yearly OPEX** which are mostly purchase of licences and additional maintenance costs due to the new equipment. *Please note that the cost of the works of BWE internal staff is not included in the yearly OPEX estimates presented below.*

The necessary **CAPEX investments** for BWE action plan implementation are up to **6,225 k\$**, which represents around 13% of its yearly turnover (collection). The **yearly additional OPEX** associated with the implementation of the action suggested are up to **907 k\$** (in 2034, considering that all actions have been implemented); which represents (regardless the impact of the change rate) an **increase of about 12% of the current yearly OPEX** of BWE (7 M\$ in 2020)².

The graph below presented the disbursements (OPEX and CAPEX) required during the next 10 years to implement the action plan.

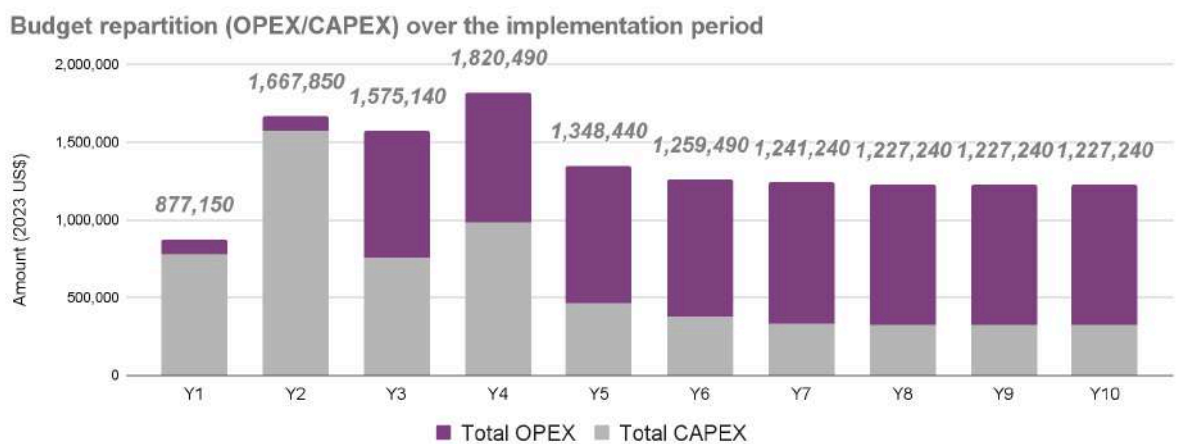


Figure 1: Action plan budget repartition over the 10-years implementation period

Between years 8 to 10, investments are planned to stabilise at 320 k\$ as they will only include the finalisation of the extension of SCADA to all BWE sites.

IMMEDIATE NEXT STEPS

Among all the actions identified, SEURECA strongly advises to begin with the ones identified below which offer quick-wins and are considered critical success factors of the Digital Transformation.

In order to create the ideal environment for BWE's digital transformation, SEURECA recommends to start by implementing the re-organisation of the WE, the structuring of the IT department (roles, policies, etc.) and of the SCADA team (roles, strategy), the implementation of change management practices.

To provide a **framework for the contracting of external technical support and the purchase of software/hardware**, and to ensure that the **solutions are fully tailored to BWE's needs**, SEURECA

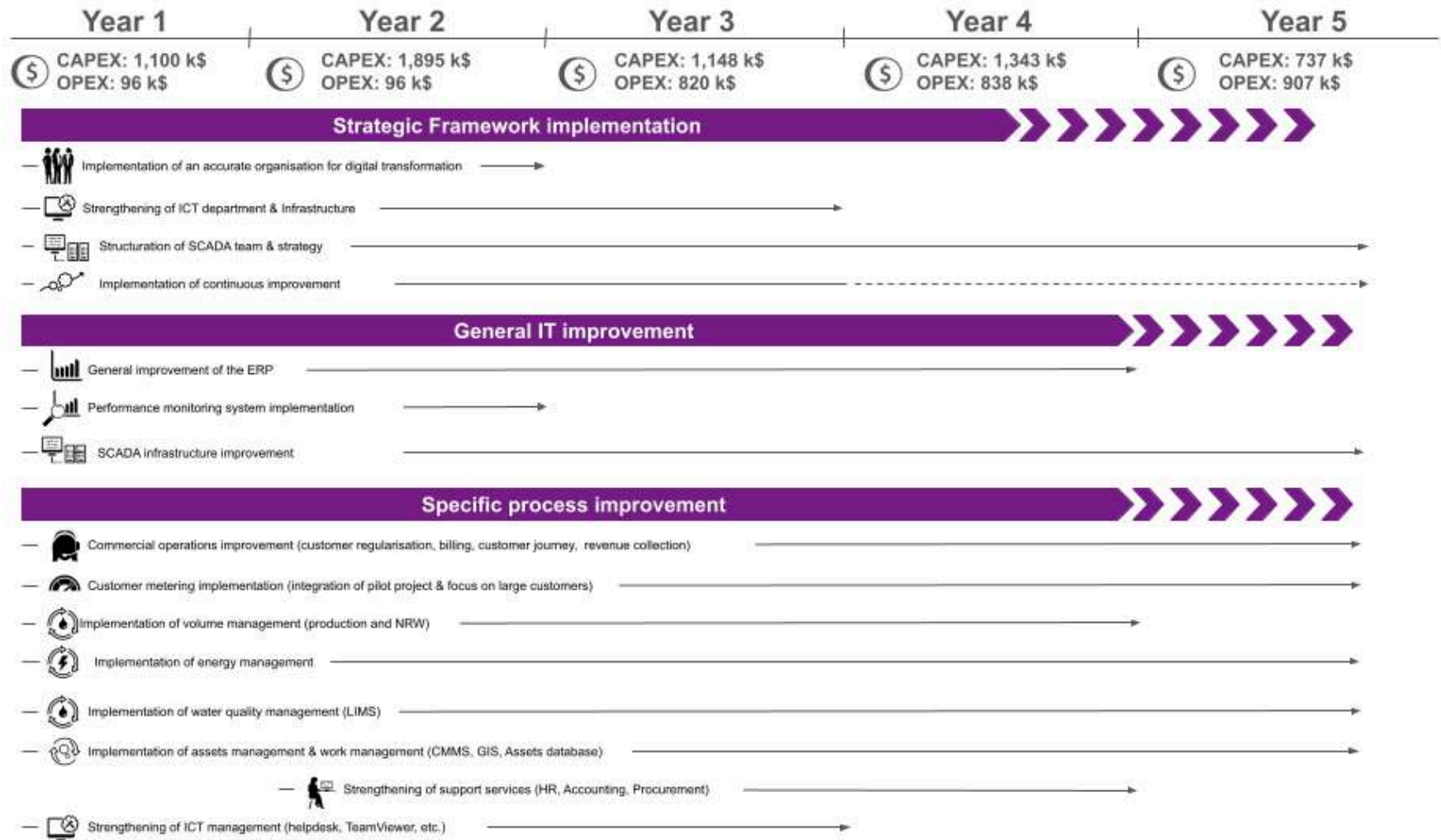
² Water Sector 2021 ... Sustain and Grow! Needs and forecast 2021-2024 - Bekaa Water Establishment - June 2021

recommends to start by drafting an expression of needs for the ERP improvement (e.g.technical specifications of the relevant modules), and a feasibility study to bring the SCADA back into service.

SEURECA recommends to **address the critical shortcomings observed in O&M** management, by structuring the overall O&M reporting (digital tools & procedures), carrying out an inventory of all assets of the WE, and launching the implementation of a CMMS, by developing the technical specifications in line with the assessment of the WE's needs.

Finally, SEURECA recommends to **quickly implement the actions that could trigger quick wins for the service**, such as the customer database update, by carrying out field-surveys, but also simply by training teams in the use of existing digital tools, and providing them with all the necessary user documentation.

The figure below summarise the priority actions (short-term) of the digital transformation action plan:



1. INTRODUCTION

1.1. CONTEXT

AFD is implementing a Programme, fully funded by the European Union, entitled “Technical Assistance Programme to support reforms in the water and wastewater sector in Lebanon” which aims to strengthen the Lebanese stakeholders in their respective functions as service operators (through the Water Establishments) and tutelage (through the Ministry of Energy and Water) as well as to support institutional and sectoral dialogue.

We understand that, following the positive experience of supporting the South Lebanon Water establishment, AFD intends to support the **Beirut Mount-Lebanon Water Establishment (BMLWE)**, the **Bekaa Water Establishment (BWE)**, and the **North Lebanon Water Establishment (NLWE)** in improving their operational performance through a **Digital Enterprise Transformation** program. It will support the development process of the Water Establishments into self-sustaining enterprises that are adequately financed via an adequate tariff structure based on optimised business, engineering, operations, management, and financial principles.



To that purpose, and as part of the signed AFD framework contract for audit-diagnosis of water and wastewater services, SEURECA has therefore been tasked with the following objective:

- Carrying out, in close coordination with those 3 Water Establishments, a diagnosis of needs and prerequisites of their current digitalisation maturity level for each business process;
- Developing an action plan for the modernization and digitalisation of each Water Establishment's operations.

1.2. OBJECTIVES OF THE REPORT

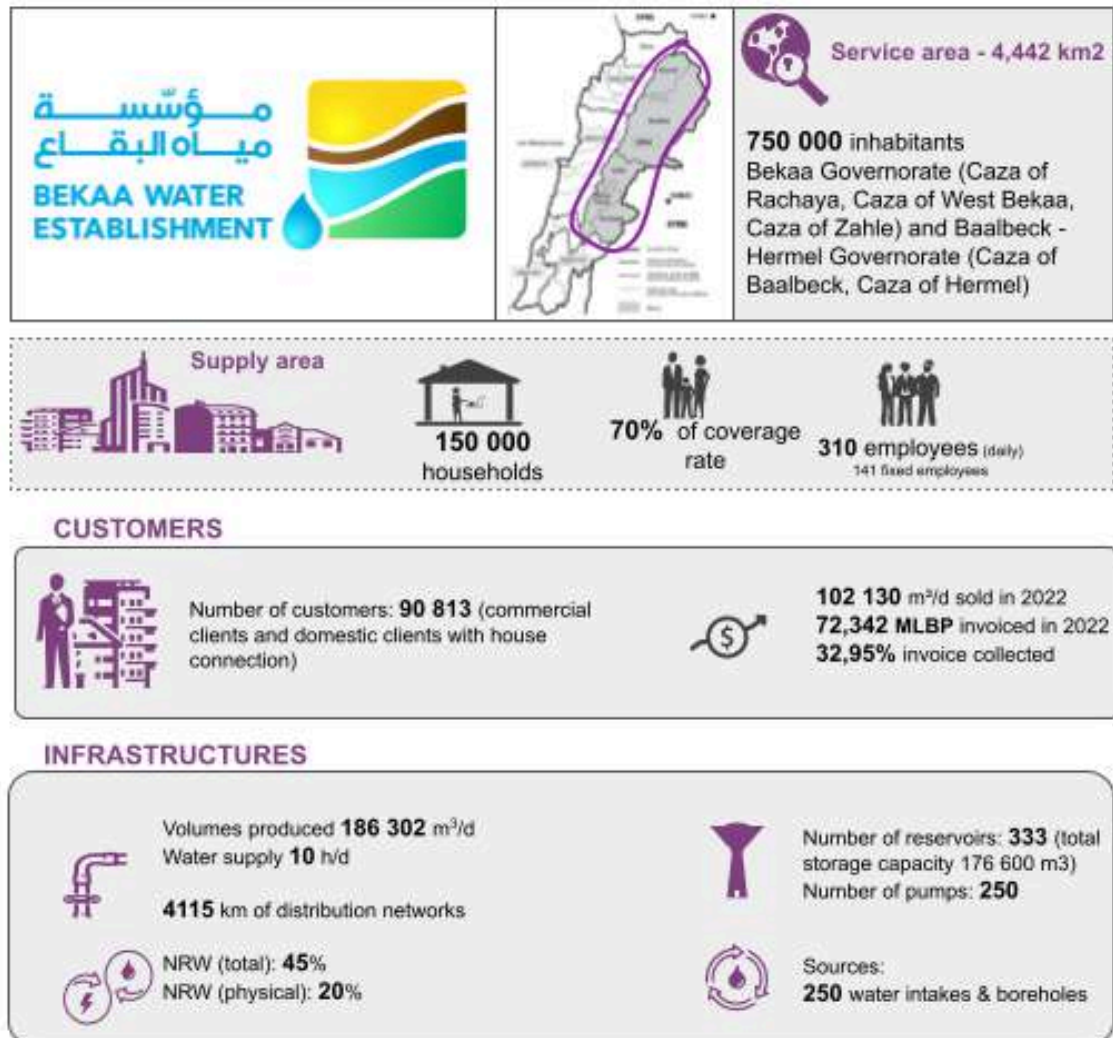
Based on the initial diagnostic mission, this report aims at **giving a vision of the current situation of BWE in terms of Digital maturity**, that could **lay the foundations of the recommendations for Digital transformation of the utility**. To this end,

- it gives first an overview of the Digital maturity of the overall BWE;
- then it focuses on each business process (IT, Customer management, O&M, etc) in order to provide more details on their organisation and Digital tools.

This report presents a **suggestion of target state at mid- and long-term**, based on the discussion with BWE's management at the end of the mission.

1.3. OVERVIEW OF THE BWE

1.3.1. MAIN INFORMATION ON BWE



1.3.2. BWE's MANDATE & ORGANISATION

BWE is an independent public organisation, with an independent budget, under the authority of the Ministry of Energy and Water.

BWE is in charge of:

- studying, implementing, operating, maintaining and renewing all potable water, wastewater and irrigation infrastructure, based on the general master plan for water supply and wastewater,
- Proposing tariffs for water supply, wastewater, and irrigation services, taking into consideration the general socio-economic conditions in the country,

- Monitor the quality of supplied drinking water, irrigation water and discharged treated wastewater at the outfalls and outflows of wastewater treatment plants.

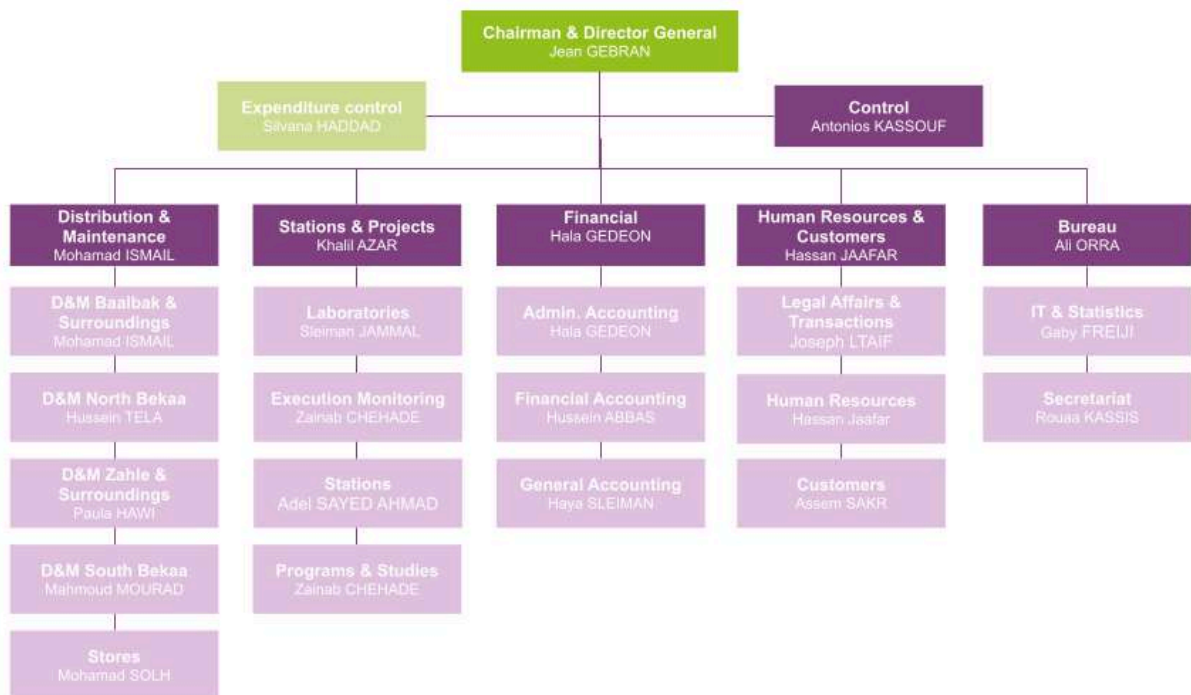


Figure 2: Organisational chart of BWE

According to SEURECA's understanding, the organisation of BWE is both geographical and functional.

Functional organisation: the departments are divided by function:

- The Department of Distribution & Maintenance is in charge of O&M of water distribution network and customer related interventions;
- The Department of Stations and Projects is in charge of project management and O&M of stations;
- The Department of Financial is in charge of finance & accounting;
- The Department of Human Resources & Customers is in charge of legal affairs, human resources and customer management;
- The Department of Bureau is in charge of Administrative management and IT.

If all support services (finances, legal, HR) and Project & studies management are centralised, customer management and operations are managed mainly by the various offices.

Geographical organisation: The supply area of BWE is divided into 4 branches (Customer service Branches), and 11 districts, or autonomous sub-systems:

- 1st Branch: D&M North Bekaa is subdivided into 2 districts: Hermel and Labweh.
- 2nd Branch: D&M Baalbeck & Surroundings is subdivided in 3 districts: Baalbeck, Deir Al Ahmar and Chmistar.
- 3rd Branch: D&M Zahle & Surroundings is subdivided into 3 districts: Zahle, Chtaura, Rayak.

- 4th Branch: D&M South Bekaa is subdivided into 3 districts: Jebjannine, Machghara and Rachaya.

Each branch and district has its own office to carry out the O&M of the distribution network (opening and closing of sub-DMA valves for instance). These offices primarily focus on technical and operational aspects and are not self-sufficient in terms of customer service and administrative tasks. It appears that IT services are centralised in Zahle main office.

It is worth pointing out that there is currently **no dedicated Director for this Water Establishment**, but an interim Director (currently the BMLWE Director). Furthermore, several positions within this organisation remain vacant to date.

- 786 positions identified;
- 335 vacant positions (42.6%);
- 141 permanent positions filled, 310 temporary positions.

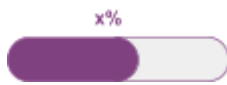
However, it is important to note that technical assistance is in progress to review the current organisation, by the Ministry of Energy and Water, and the AFD.

2. FOCUSED DIAGNOSTIC BY BUSINESS PROCESS

This chapter focuses on each business in order to provide a more detailed assessment of each one. The business processes corresponds to the main categories of activity of the WE, so they include various of its units, as presented below:

Business process	BWE's units
IT management	IT unit (Bureau) (HQ)
Operations & Maintenance	Stations section (Stations & Project department) (stations units and sites)
	Laboratories section (Stations & Project department) (main laboratories & sub laboratories units)
	Distribution & Maintenance department (branches and sites)
	Stores section (Distribution & Maintenance department) (branches and sites)
Customer management	Finance accounting section (Financial department) (HQ and branches)
	Customer section (Human Resources & Customers department) (HQ and branches)
Financial & accounting	Administrative accounting section (Financial department) (HQ)
	General Accounting section (Financial department) (HQ)
Administrative, legal, HR (incl. HSE/QMS)	Secretariat (Bureau) (HQ)
	Human Resources section (Human Resources & Customers department) (HQ)
	Legal affairs & Transactions section (Human Resources & Customers department) (HQ)
	Control section
Technical	Programs & studies section (Stations & Projects department) (HQ)
	Execution monitoring (Stations & Projects department) (HQ)

Table 2: Business process repartition



In the detailed diagnosis described in the following paragraphs, the level of digitisation is assessed according to the criteria mentioned in the table below:

Oral only	Standardised forms and data collection in paper form	Sheet / Excel	Dedicated Software	Integrated software / links	Hypervision
(incl. phone...)	"Digitalisable" processes	(inc. standard database)	ex. GIS, CMMS, CC&B	ex. integrated ERP	Digitalisation from field to dashboard
0%	20%	40%	60%	80%	100%

Table 3: Digital scale

This diagnosis is carried out from a theoretical point of view, aimed at analysing the existence and capacity of the tools. However, it does not take into account the concept of user competence. This aspect of change management will be assessed in the Chapter 3 "Overall digital maturity diagnostic of BWE".

2.1. DIAGNOSTIC OF THE IT MANAGEMENT PROCESS

2.1.1. MANDATE

The IT department is responsible for overseeing:

- the maintenance of all desktops, servers, storage and network equipments;
- the administration of the network infrastructure;
- the administration and maintenance of the digital tools databases;
- the management of the warranty and support contracts;
- the daily backup of the databases, systems, and network equipment;
- the disaster recovery;
- the user support.

It should be noted that everything relating to the development of the ERP is handled by an external specialist (DAI) sponsored by UNICEF, although it is being supervised by the IT team manager.

2.1.2. ORGANISATION

The ITC department is part of the Bureau. It is organised as shown below:

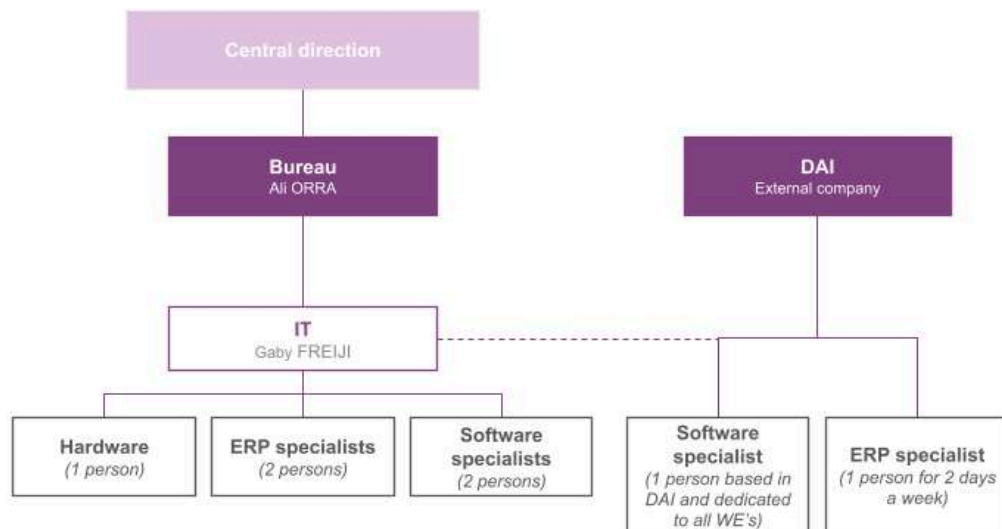


Figure 3: Organisational chart of IT unit

The team is composed of:

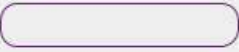
- 1 IT manager handling:
 - all the backup operations,
 - coordinating the ERP improvement project with DAI team,
 - coordinating BWE IT team,
- 1 hardware specialist supporting all SWE staff with hardware issues;
- 2 ERP specialists handling first level support for the ERP (bug fixing, access issues);

- 2 software specialists supporting all SWE staff with non ERP software issues;
- 1 DAI external staff (part time) for ERP management (business development, user support, bug fixes, etc). The contract is renewed yearly;
- 1 DAI external staff (part time) for other IT related topics (based in Beirut, and “shared” between the 4 WEs).

There is no cybersecurity dedicated expert within BWE, a subcontractor is used if necessary for firewall configurations.

2.1.3. ASSESSMENT OF SUB-PROCESSES DIGITALISATION STATUS

Based on the interviews and on the on-the-job observations, an assessment of the digital tools used in each sub-processes was carried-out, as presented in the tables below, in order to identified the status of digitalisation of each one and the main shortcomings in the current situation

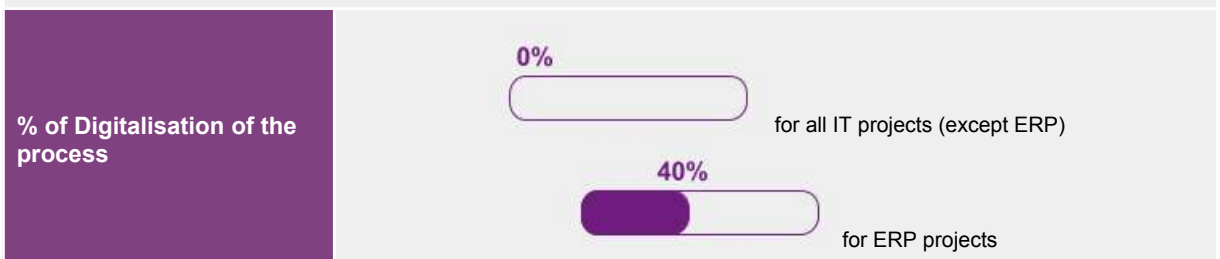
Governance and strategic planning	
Tool	-
Users	Bureau (IT unit)
Uses and Shortcomings	
<ul style="list-style-type: none"> • There is no IT strategy nor digital roadmap. • The IT policies do not exist. 	
% of Digitalisation of the process	0% 

Project management	
Tool	Microsoft Excel
Users	Bureau (IT unit)
Uses and Shortcomings	
<ul style="list-style-type: none"> • Many IT projects are outsourced: the ERP is outsourced to DAI (an American company) and financed by USAID, the customer website project is carried out by UNICEF. • All IT-related projects are referred to the IT team to ensure the feasibility of integrating the tools into the servers, to consider the various interoperability constraints → interoperability principles have not yet been developed and it could be good practice to initiate at this stage. 	
ERP specificity:	
<ul style="list-style-type: none"> • Department staff proposed evolutions/changes on the ERP, which are collected and prioritised by the IT manager and then discussed with DAI for implementation budget. • The DAI specialist provides monthly progress reports to the IT team. 	

No.	Scope of Work
A1	Modify and implement three (3) modifications published by the NSSP on the ERP system to allow the staff to benefit from the new incentives
A2	Monitor and support the billing process procedures for 2023 to ensure issuing all the invoices for subscribers with their related reports and provide support when necessary
A3	Perform modification and enhancements on the billing and collection module to include the following:
	Installment method for current year
A3.2	Apply a dynamic procedure in the subscriber ledger
	Enhance amounts balances related to subscribers
A3.4	Modify the irrigation procedures in the system
	Correct and reconcile any old data identified as non-identical with the previous Access software
A3.6	Apply a redesigned procedure for generating the annual billing (not related to the Work Force Management table)
	Create a new method to apply adjustments in the collector report
	Add a report that contains detailed information on villages/municipalities, separate by dates old and new subscriptions to show the contracted quantities and types (rent/owned, gauges/meters, connected to wastewater facilities/not connected)
	Continue working on the collection report when finalizing the enhancement
A4	Perform modification on the budget module to include the following:
	Template that shows the annual budget statement
	Budget lines that need to be carried over for the next year
	Carried over report layout
	More columns in the annual budget statement report
	User Permission when closing the fiscal year
A5	Modify minor adjustments in the procurement module
	Enhance reports related to the warehouse module
	Enhance reports related to the document register module
A8	Develop user guide manual for system administrators and class diagram

Figure 4: List of corrections / evolutions requested on the ERP

The IT team does not have a list of all ongoing IT projects → The absence of such a list results in a lack of visibility, coordination, and an inability to prioritise efforts.



Network and security Management	
Tool	Firewalls management (Sophos, Jup (managed externally), Sophos antivirus)
Users	Technical Department (IT unit)

Uses and Shortcomings

Network management:

- BWE operates a WAN architecture to connect the headquarters with the branch offices (refer to the figure 5 below). The network speed (10MB) is currently sufficient as it is only used for ERP connection and few internet connections but would not allow enough bandwidth if a cloud based approach is implemented.
- The infrastructure is secured via a Sophos and Juniper firewall (managed externally), including a VPN to allow access to the server from the staff smartphone → although this solution is practical for staff (for remote management of backups or SCADA monitoring), it is not without risks and needs to be handled carefully.
- The internet is provided by Pesco Telecom and BWE is satisfied by the service

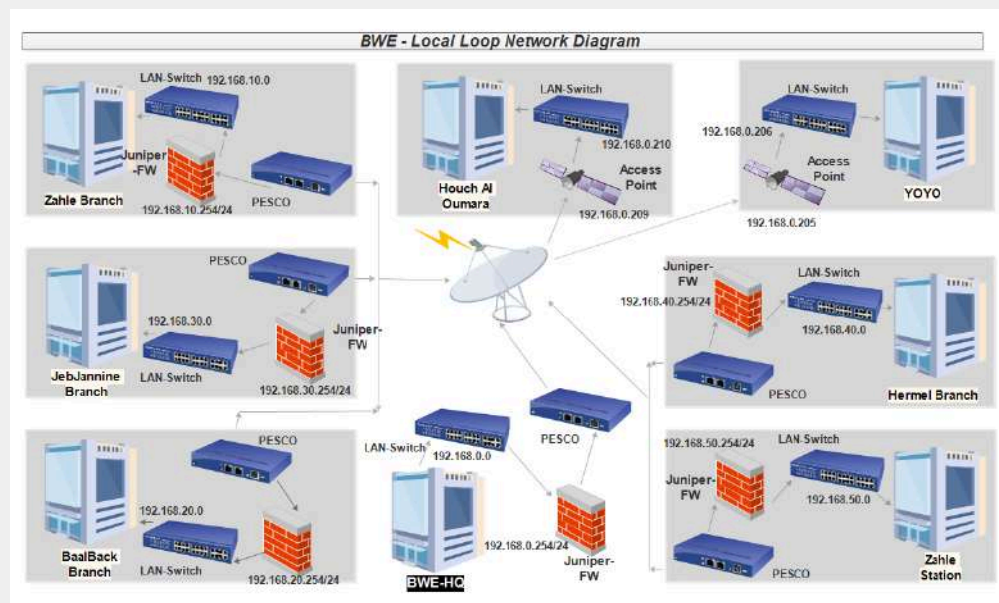


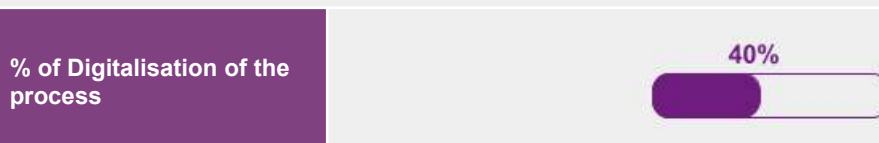
Figure 5: BWE network representation

Cybersecurity:

- There is no security procedure in place, security only relies on hardware installed. IT staff are used to accessing critical IT assets (server) on their mobile phone.
- **There was no security audit ever performed.**
- Security policies are implemented such as domain password, antivirus and firewall rules, and restriction on employees' computers to prevent installation of unauthorised software.
- Only a limited number of employees have Internet access on their work computers (managers and engineers) → it limits the risks of hacking and fishing.

Site security:

- CCTV (5 cameras per branch) systems are also managed by the IT unit, however they are facing difficulties to maintain the system due to the regular site maintenance requiring travels and associated costs (gas for the car).



Hardware and Software Management - Asset Management	
Tool	-
Users	Bureau (IT unit)

Uses and Shortcomings

Hardware:

- All hardware, from the server room to the desktops, is listed in an Excel file. The level of detail in this list, although essential, does not allow real monitoring of the condition of individual devices, or asset valuation, and only gives an idea of the current equipment. Adding the location (and user) of the equipment, as well as the update dates, would also enable better management;

#	Description	Quantity
1	Switch POE 24 Port	5
2	Switch 24 Port	4
3	Switch POE 48 Port	4
4	Switch 18 port	2
5	Juniper FireWall	4
6	Router 3COM	2
7	Canon Photocopy C3525i	8
8	Yealink IP Telephony	80
9	Snom IP Telephony	4
10	UPS Vertiv	1
11	FIAMM Battery 95 Ah	24
12	Hand Punch 1100 & 2200	21
13	Battery 75 Ah	40
14	UPS Central 5KVA	2
15	Panasonic Central KX-NS500	1
16	UPS Baalback branch	1
17	UPS Jebjaninne branch	1
18	Battery 200 Ah	8
19	DVR	1
20	Camera	10
21	Inverter Dell	1

Figure 6: Excel file with hardware list

#	Description	PROCESSOR	RAM	HDD	BIT	OPERATING SYSTEM	Quantity
1	Desktop HP	Intel® Core™ I7	16.00 GB	1 TB	64	Windows 10 Pro	25
2	Desktop Lenovo	Intel® Core™ I7	8.00 GB	1 TB	64	Windows 10 Pro	7
3	Desktop Lenovo	Intel® Core™ I5	8.00 GB	1 TB	64	Windows 10 Pro	28
4	Desktop HP,DELL	Intel® Core™ I5	4.00 GB	500 GB	64	Windows 7	38
Total							98

- This Excel file is updated annually.
- There is no tracking of the valuation of IT assets in this Excel file (managed by procurement).
- Most hardware was donated by several parties and a part purchased by BWE.



RESPONSIBLE & SUSTAINABLE DIGITAL

Best practice in responsible digital use encourages the **replacement of computers every 8 years** (minimum 5 years).

It is recommended to avoid mass renewal and segment the **renewal in tranches of 20% of the existing equipment**. It should be noted that hardware replacement should only be encouraged in the event of a failure and if repair is impossible.

Another good practice is to carry out a **complete update of the PC every year**, with cleaning etc. (when the employee is on holiday, for example), so that the hardware is up to date in terms of software, licences and security, while extending its lifespan as much as possible.

Software & Licences:

- The software is also listed in the same Excel file (cf screenshot below) that provides only a description of the software. Completing this file with at least the version and the number of users would be valuable to improve the licence follow up. The Excel file is updated annually.

BWE/IT Software - Head Office & All Branches		
#	Description	Comment
1	Microsoft Dynamic Navision 2018	Dynamics NAV is an enterprise resource planning (ERP) app that assists with finance, manufacturing, customer relationship management (CRM). The ERP system has been adopted by the BWE since 2014 and is funded by USAID
2	SQL Server 2017	All organization information is stored on SQL
3	GIS	creates, manages, analyzes, and maps all types of data. GIS connects data to a map, ...
4	Uagent For Call Center	Receives phone calls from the subscribers and saves the subscriber's information, after which the complaint is recorded on the ERP system, the Uagent system has been adopted by the BWE since 2019 and is funded by Unicef
5	Sophos Antivirus	Its software provides critical malware, phishing website, and ransomware prevention, the sophos antivirus is funded by USAID
6	Microsoft Office 365	Creates an email for all employees
7	Veeam Backup&Replication 10	Saves a copy every day of all programs
8	Hprocom	It works to extract the employee's fingerprint from the HandPunch machine
9	Time Management	It takes the fingerprint from the hprocom program so that we can get the employee time

Figure 7: Existing software list

- The yearly licence cost for all software is estimated at 14k\$ (usually around 16% of the cost of the tool) by the IT manager and integrated in the budget → however this amount, in dollars became impossible to pay due to the inflation.
- Thus, most of the licences are paid by the NGOs, which usually cover only the first year.
- The IT manager tracks the existing licences → this tracking is a good beginning to improve efficiency and optimization, however it remains light (no information regarding the quantity of licences, the name of users etc).

Items	Renewal Date	Annual Cost	Status
GIS	2/1/2024	-	Active
ERP Navision	January 2024	-	Active
Office 365	February 2024	-	Active
Website Hosting	14/9/2024	-	Active
Sophos Antivirus	1/6/2026	-	Active
Firewall Sophos	1/4/2025	-	Active
Domain name	1/7/2024	-	Active

Figure 8: Existing licence list

- The software maintenance as user support, virtual machine management, software updates and patches, etc. is carried out by the IT teams, except for the ERP and firewalls. Regarding the user support, refer to the User Support section for more details.

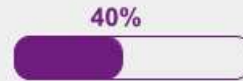
Servers management:

The servers and infrastructure is managed by the BWE team supported by subcontractors if needed.

- An access secured (access control, CCTV), air conditioned , fire protected server room in the Zahle office hosts all the servers of BWE infrastructure;
- Server hardware is 4 years old and limited CPU power has been identified as the reason for ERP performance issues (**more than 15 min to validate a modification in the ERP**);
- In case of electricity shortage, a diesel generator and batteries keep the server room running.

SEURECA has not found a list that allows tracking of existing hardware and software with user name → the lack of tracking inevitably has an impact on the efficiency of management and optimization.
The IT manager is responsible for suggesting CAPEX and OPEX requirements for the budget.

% of Digitalisation of the process



Data Management, documentation and SOPs

Tool	-
Users	All BWE staff

Uses and Shortcomings

- There is no dedicated data governance.
- Data is stored on a shared folder on the servers.
- There is no documentation for the digital tools except the user manuals for customised modules, but nobody uses them. It is advisable to include a link in the module to the documentation to make it easier for the user to access.
- There is no SOP corresponding to IT team operation.

% of Digitalisation of the process



User support

Tool	Phone, email, dedicated ERP email address, TeamViewer, Whatsapp
Users	Bureau (IT unit)

Uses and Shortcomings

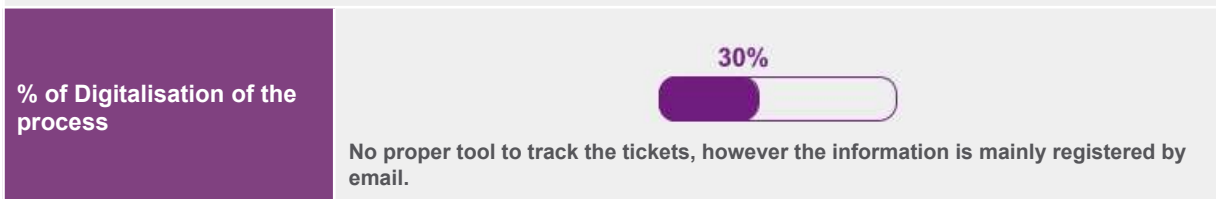
- The user with an issue can contact the IT team by phone (call or Whatsapp) or by email (40 contacts per day - emails or calls)
 → The helpdesk monitoring process is not formalised and everything is done verbally, which complicates the follow-up of resolutions and **is detrimental to the team's efficiency**. In addition, **the lack of a structured system makes it difficult to analyse and improve performance**.
- The IT team can take control of the computer remotely (through TeamViewer) or if it requires, the support team travel to the site;
 → The fact that the IT team is centralised and that there is no help desk management tool has a real impact on the resolution time. Plus the current lack of gas makes the site travel complicated.
- To request the provision of a computer, the user needs to submit a written request, stamped

by the hierarchy → the dematerialisation of the process and acceptance of the eSignature would accelerate the procedure.

- On going project to develop a module for the user support in the ERP:
 - Creation of a ticket by the user, with a screenshot of the issue;
 - Assignment of the ticket to a “follower”, in charge to correct the issue;
 - Once the issue is corrected, the administrator can change the ticket to “Solved” to inform the user.

ERP specificities:

- The process and shortcomings are similar to the IT support operation, except that a dedicated email address has been set up for the issues related to the ERP.

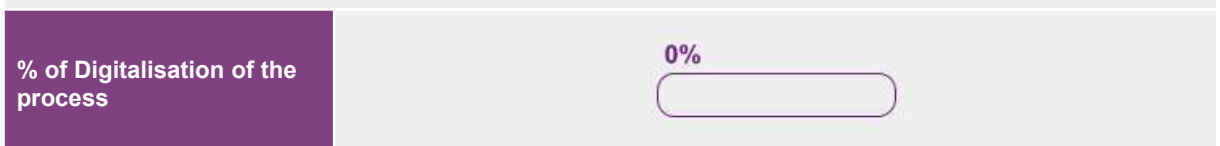


Vendor and supplier management

Tool	-
Users	Bureau (IT unit)

Uses and Shortcomings

- Communications to vendors and suppliers are made by emails or official letters.
- Contracts are handled by the procurement department.



Disaster Recovery and Business Continuity

Tool	Veeam Backup & Replication 10
Users	Bureau (IT unit)

Uses and Shortcomings

Disaster recovery:

- **There is no business continuity plan** but backups are performed regularly.

Backups:

- **Daily backup:** Veeam Backup & Replication 10 is widely used, but it does not perform incremental backups. Instead, it overwrites the data, resulting in only one day's worth of recorded backups.
 Thus, every day, a full backup is scheduled in the afternoon automatically.

All software, including ERP and SCADA, are backed up with Veeam software. These backups include the databases.

The team verifies daily that the backup data is complete.

- **Weekly backup:** Every week, an external backup is created for the VM configuration as a precaution in case the daily backup becomes corrupted. However this backup does not include the data.

The external backup process takes approximately 2 hours and is performed solely by the IT manager. There is no specific day scheduled for the backup, and it can be done using the phone (through the TeamViewer app).

% of Digitalisation of the process

70%



Training and Skill Development (on digital tools)

Tool

-

Users

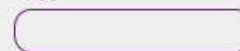
All BWE staff

Uses and Shortcomings

- **BWE staff didn't get dedicated training on most software.**
- 1 to 2 people from each department received light ERP training in 2019, but no refresher training has been given since, and handovers have not been carried out properly.
- Training guides are not shared nor stored on the server → keeping these user guides in a common area would allow employees to have detailed documentation to refer to, whether in the event of a problem or in the case of a new arrival.
- No eTraining available.

% of Digitalisation of the process

0%



2.1.4. SUMMARY

The digitization assessment of sub-processes can be summarised as shown below. It is important to note that this representation does not define digital maturity, but it contributes to the overall understanding of the role of digitalization in the business.

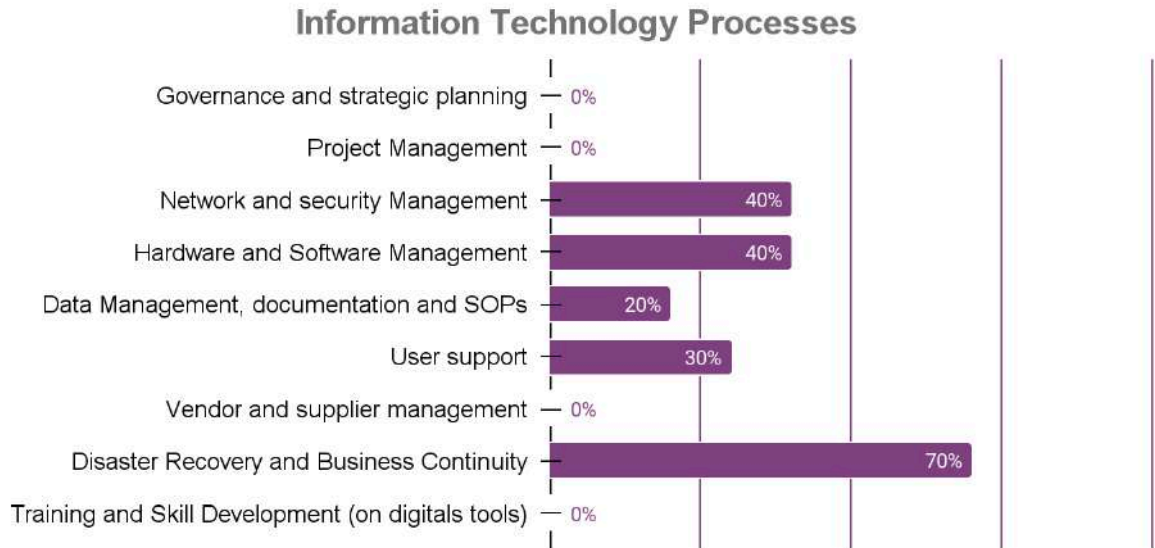


Figure 9: Digitalisation overview of the IT subprocesses

2.1.5. SWOT

Based on the initial mission diagnostic, the SWOT matrix below displays the key elements of the diagnostic performed at a department/unit level:

Strengths	Weaknesses
<ul style="list-style-type: none"> • Qualified team; • Quality user support (90% of problems are solved remotely using TeamViewer); • Strong financial contribution of USAID (software, licences, hardware, training...); • Relevant overall infrastructure; • External experts support (DAI for the ERP). 	<ul style="list-style-type: none"> • Lack of maintenance or replacement of desktop leading to degraded operation conditions (eg. laboratory); • Lack of cybersecurity audit; • Lack of IT master plan; • Lack of overall documentation (training, user manual...); • IT operations are not formalised in SOP; • No preventive maintenance (and update).
Opportunities	Threats
<ul style="list-style-type: none"> • On-going project to add a helpdesk module in the ERP (ticket tracking). 	<ul style="list-style-type: none"> • Undersized hardware for ERP use; • Centralization of IT service making the user support difficult; • Residual duration of USAID support is not properly established;

	<ul style="list-style-type: none"> • All licences, maintenance & support fees are in USD and hard to handle due to the economic crisis and LBP inflation (WAN connection, mobile app subscription, web development and hosting, UPS maintenance, photocopier maintenance...); • No business continuity plan.
--	--

2.1.6. MAIN RECOMMENDATIONS

The diagnosis of the level of digitalisation of the process has led to a number of recommendations, categorised as:

- “organisation”: reorganisation of teams, cross-team communication, clarification of task allocation, recruitment, etc;
- “skills”: training to be provided;
- “tools”: need for new software or hardware, licences, software improvements, etc;
- “processes”: formalisation of new processes, revision of processes with shortcomings, etc.

These recommendations are prioritised as follows:

- 1 - High priority: action to be addressed in the 1st coming year;
- 2 - Medium priority: action to be addressed in the 3 coming years;
- 3 - Low priority: action to be addressed in the 5 coming years.

Category	Recommendations	Priority
Organisation	Create a IT master plan	1
	Appoint an IT resource responsible to track the different IT project	1
Skills	Improve the tool usage by sharing with the end users all the tool documentation (ERP...)	1
	Strengthen the cybersecurity awareness by providing training to employees using computers	1
Tools	ERP update to Business Central to simplify the creation of modules and integration - reinforced by the fact that Navision will soon be obsolete	1
	Update server hardware in order to operate the ERP in good conditions	1
	Organise the helpdesk by creating a module in the ERP to track the requests/intervention of the team	2

	Insert the existing ERP user manual in the relevant ERP module	2
Processes	Complement the list of existing software, with the version, number of licence, usernames and rights	1
	Create a list to track the existing hardware, with the date of installation, last update, and usernames	1
	Create a list to track the ongoing projects, with the description of the objective, the key contacts, the CAPEX, the OPEX, the delivery date and progress	1
	Include in the weekly backup the operational data and not only the VM in case the daily backup gets corrupted	1
	Streamline the management of IT assets, it is recommended to integrate them into an asset management module within the ERP system	3
	Write SOPs for all processes (helpdesk, disaster recovery...)	1
	Create a business continuity plan	1
	Create a renewal plan for hardware following the Responsible and Sustainable Digital best practices	1
	Initiate interoperability principles while the number of applications is limited to ensure a correct communication with the future digital tools	2
	Perform of a cybersecurity audit	1
	Create the missing IT policies (eg Security Awareness and Training Policy, Remote Access Policy, Data Protection and Privacy Policy, Password policy...)	2
	Encourage NGOs to cover OPEX in their project proposals, or refuse projects that do not have the necessary OPEX funding	1
	Establish a "project mode" for IT projects by designating roles (empowerment of a project manager and contributors) and a schedule	1

Table 4: List of IT management business process recommendations

2.2. DIAGNOSTIC OF THE OPERATIONS & MAINTENANCE BUSINESS PROCESS

2.2.1. MANDATE

The operation and maintenance of technical facilities (production, distribution and wastewater treatment facilities) are carried out by 2 departments:

- The Station & Projects (except “Programs & Studies”);
- The Distribution & Maintenance department.

The main tasks of the Station & Project Department are:

- Operation and maintenance of Water Treatment Plant in Bekaa region;
- Operation and maintenance of Pumping Stations in Bekaa region;
- Operation and maintenance of Tanks in the Bekaa region;
- Water quality monitoring (laboratories).



Figure 10: Zahle Water Treatment Plant

There are 4 main stations in the regions:

- Zahle with 9 wells and a treatment station with no well;
- Shamsine with 6 wells and 6 boosters;
- Lucy with 3 wells and 3 booster pumps;
- Hermel with 3 booster pumps on the Ras El Mel spring;
- Around 250 wells in the region, according to the interviews.

The department is in charge of a central laboratory and monitors the water quality of the whole establishment.

The main tasks of Distribution & Maintenance department are:

- Maintenance and operation of the networks (valve operation, repairs, etc.);
- Site technical survey for new customer including connection installation;
- Meter shut-off in the event of non-payment;
- Illegal connection tracking;
- Warehouse management.

The region uses **sequenced supply**. A project to install flowmeters was initiated in 1999 in 19 villages, but the project was quickly abandoned.

Sewerage systems:

The wastewater treatment facilities are being transferred back to the establishment. The current state of the facilities are as below:

WWTP Facility	Size (m3/day)	O&M	Funded by
laat	12000	BWE with support from UNICEF, through technical staff who worked with the former private operators and also through BWE staff.	EU
laat	10000	BWE with support from UNICEF, through technical staff who worked with the former private operators and also through BWE staff.	EU
Zahle	37000	UNDP/ BUTEC	Italian Cooperation
Saghbine	560	BWE, but BWE is promised to be supported in O&M by USAID through a private operator or by employees of the former operator and BWE staff.	

Table 5: Wastewater facilities

It should be noted that according to the water law 221/2000 and its amendments, wastewater treatment is the responsibility of the Lebanese Water Establishments. However, the existing or current organisation chart of BWE does not mention a specific department for wastewater. At present, it is the Stations and Projects Department that deals with this task through a provisional wastewater treatment unit created by the General Management.

2.2.2. ORGANISATION

Those departments report to the General Director. There are organised as shown below:

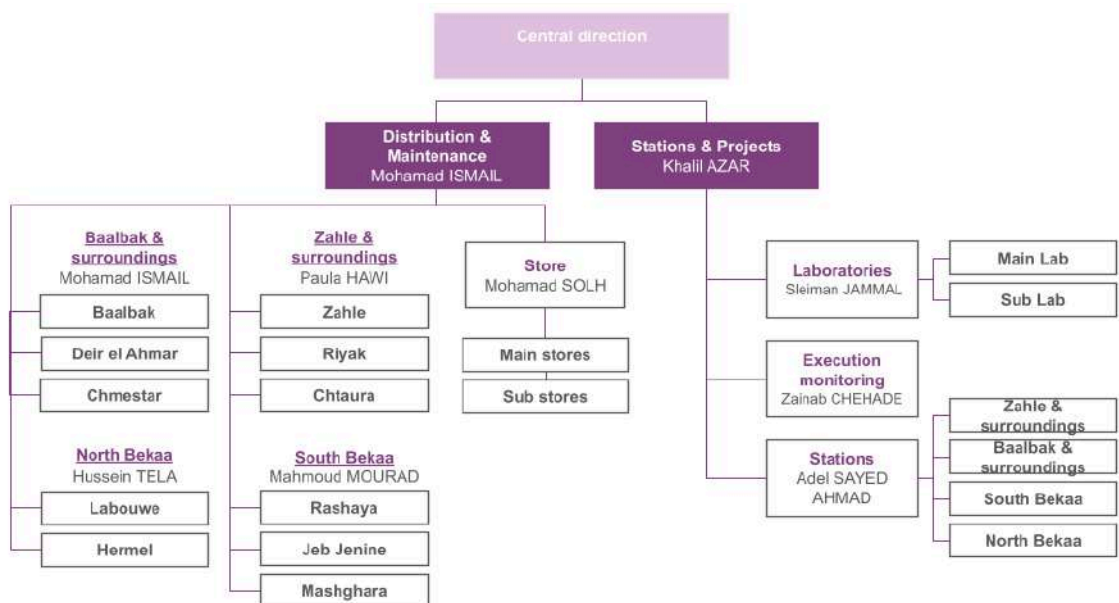



Figure 11: Organisational chart of the departments involved in Operations & Maintenance

The number of operators needed to run the sites and the network is officially 136 (excluding the wastewater operations, which have not yet been integrated). There are currently 80 employees in these departments. According to our interviews with the heads of departments and because of the economic and financial situation which has negative effects on BWE, a majority of the staff is demotivated and less and less invested in their work.

2.2.3. ASSESSMENT OF SUB-PROCESSES DIGITALISATION STATUS

Based on the interviews and on the on-the-job observations, an assessment of the digital tools used in each sub-processes was carried-out, as presented in the tables below, in order to identified the status of digitalisation of each one and the main shortcomings in the current situation:

Manage work tasks - Above Ground Assets / Water Treatment Plant	
Tool	SCADA
Users	SCADA operators
<p>Uses and Shortcomings</p> <p>For the sites not supervised by the SCADA, the equipment is operated locally; operators have to start/stop the pumps from the local electrical panels. Most of these sites don't have flowmeters so production is calculated using pump running hours (sent to management via whatsapp) and approximate pumping ratio per equipment.</p> <p>For the sites supervised by the SCADA (about 30% of the total sites), the control is done remotely by the SCADA operators during working hours. If there is a need to operate equipment off the clock the local operator has to bypass the SCADA system (refer to "2.3. Focus on SCADA" for more details). They are flowmeters on most of the production sites supervised by the SCADA but production numbers are not yet compiled in a report (reports being set in the SCADA system).</p> <p>In both cases, site operators or SCADA operators don't have a water distribution program or a planned schedule, they operate equipment based on the available electrical power (from ZDL/EDL or generator requiring diesel from donors) to distribute water evenly to customers.</p> <p>There is no preventive maintenance. No paper culture for the inspections of the sites, oral communication is generalised.</p> <p>As there is no intervention monitoring, there is no history kept regarding the assets.</p>	
% of Digitalisation of the process	

Manage work tasks - Underground Assets

Tool Arcgis, Microsoft Access

Users GIS expert

Uses and Shortcomings

Asset management:

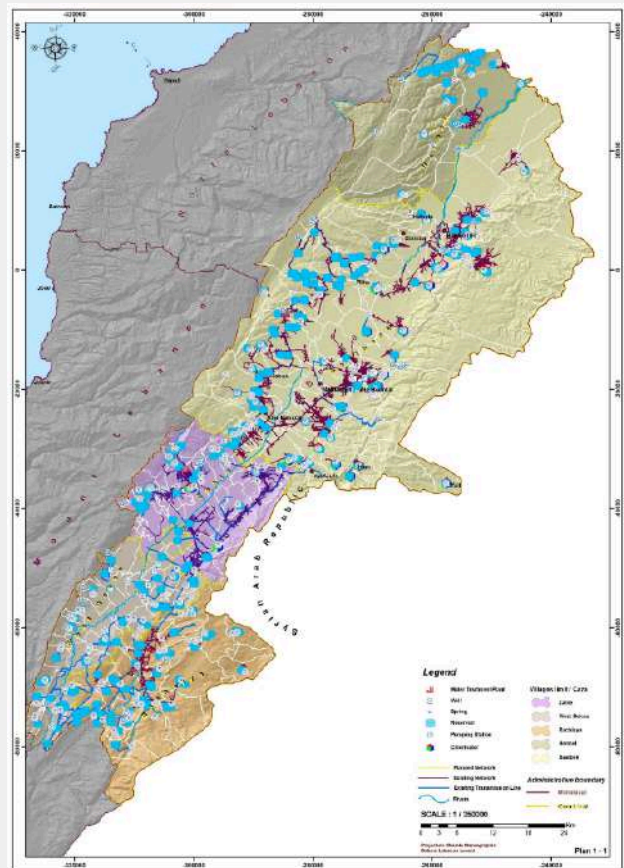
The GIS database is regularly updated by one employee (financed by Unicef) since 2015.

It includes the following layers:

- Wells;
- Reservoirs;
- Water treatment plants;
- Wastewater network;
- Water network;
- Pumps.

The initial master plan of the network was published in 2015, using data gathered in 2013.

Figure 12: GIS Master Plan (2015)



Since the master plan, the database has been updated with 206 new projects using the following process:

- Project managers create an AutoCAD file;
- They provide the AutoCAD file to the GIS expert via a USB drive;
- The GIS expert saves the project file on their PC in organised folders;
- The GIS expert manually integrates the project into the master plan.

Water quality data is also integrated regularly into the GIS, using the following process:

- Every 2 to 3 months, the laboratory employees compile the quality data in an Excel file with a single tab, and give it to the GIS manager via a USB key;
- The data is manually compiled in Microsoft Access;
- The compiled data is integrated into the GIS;

- To date, no use has been made of the water quality data available on the GIS.

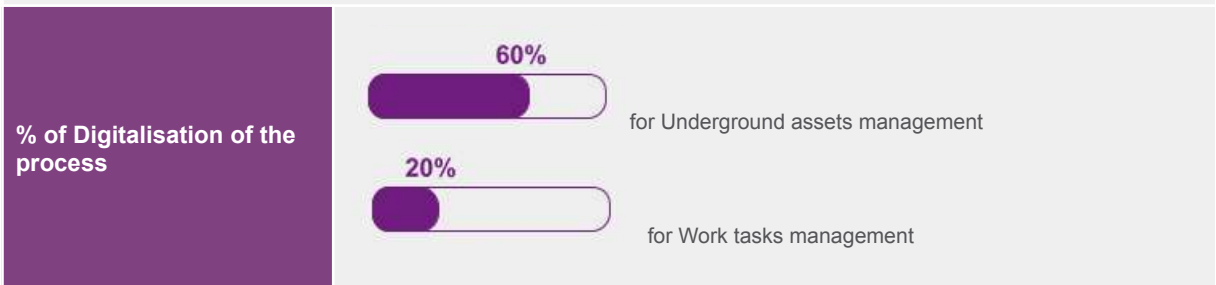
The current uses of the GIS can be internal or external, such as:

- Request from the Ministry to check the location of BWE wells (to ensure that private wells are more than 500m away);
- As part of a new project (network, installation) in the region to obtain information on the existing situation;
- As part of a road project, to check the location of pipes, etc.

There are no existing SOPs and only the GIS expert is able to update the database. Several projects have been proposed to improve GIS management but have not been implemented. Customers are not currently linked to the GIS, but it could be easily implemented by linking each client to the lot number of the land (which is unique for each plot).

Interventions - Work Task management:

- Interventions are triggered by complaints or visual observations;
- Maintenance of the network assets as well as new connection creation is performed by O&M staff following a paper process;
- The O&M team doesn't have direct access to GIS. When they need information on the underground assets, they request it from the GIS expert.

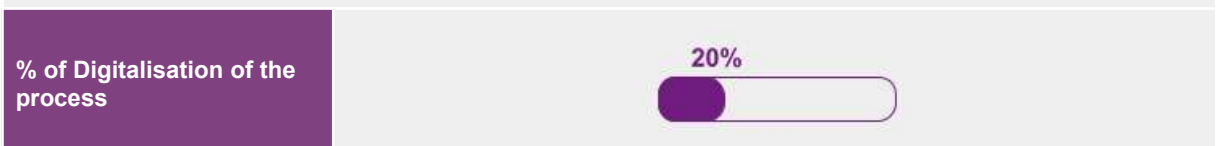


Alarm Management	
Tool	Partly covered by main SCADA
Users	SCADA operators - electromechanical staff

Uses and Shortcomings

Alerts mainly come from customers, in which case there is no existing formalised process. To a lesser extent, an Alarming Feature is available on the main SCADA (~30% of facilities) but they can be treated only during SCADA operators working hours.

Refer to Chapter 2.3. "Focus on SCADA" for more details



Manage stocks & warehouse

Tool	ERP Microsoft Dynamic Navision 2018
Users	Store unit (Distribution & Maintenance department)

Uses and Shortcomings

The ERP includes a warehouse modules to manage the following elements:

- Pipe;
- Accessories;
- Pump and motors;
- Water Meter;
- Tools for maintenance.

But this ERP module is no longer used in the current process as the inventories follow up has been stopped.

The process for taking a part in the warehouse involves several paper validations and **takes an average of 1 month**, it could be described as below.

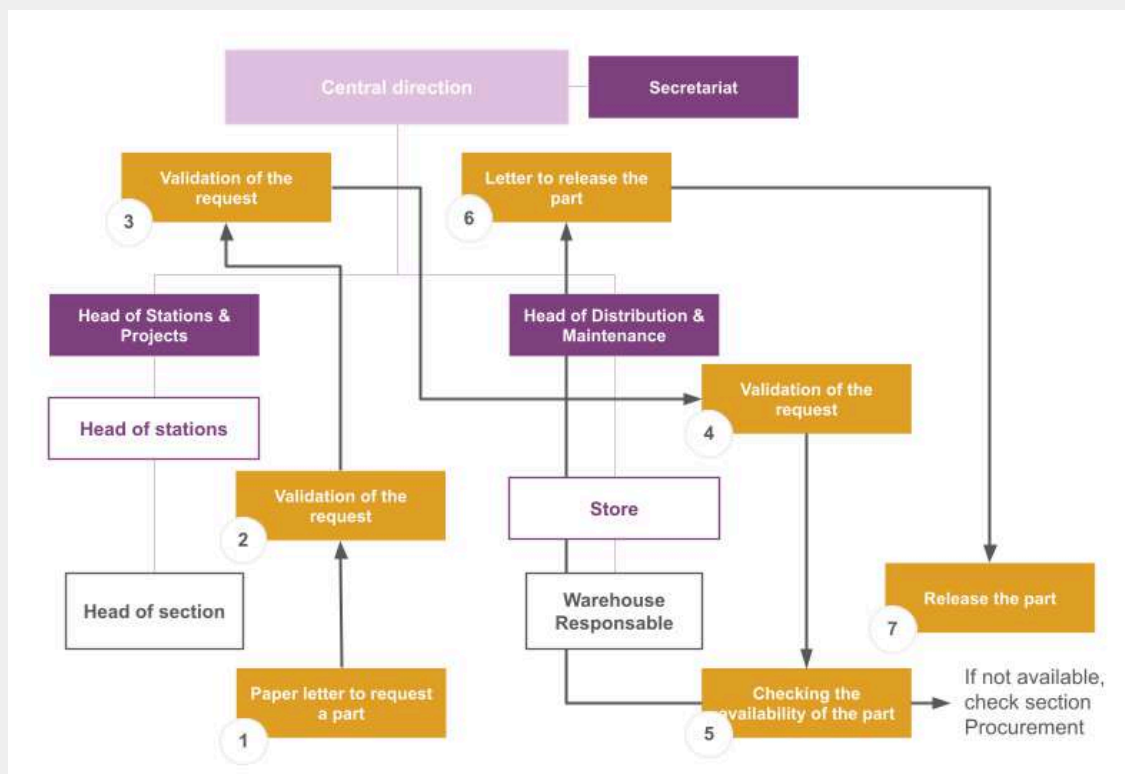



Figure 13: Part release in the warehouse process

% of Digitalisation of the process



Monitor energy consumption	
Tool	Partly covered by main SCADA
Users	-
<p>Uses and Shortcomings</p> <ul style="list-style-type: none"> • The energy consumption is only tracked in Zahle station, but not on a regular basis. • Some wells are powered by solar panels or generators. • The new facilities integrated to the main SCADA are typically equipped with power measuring units for pumps and utility energy supply. There is currently no regular reporting / tracking of this data. <p>Refer to Chapter 2.3. "Focus on SCADA" for more details.</p>	
% of Digitalisation of the process	0% 

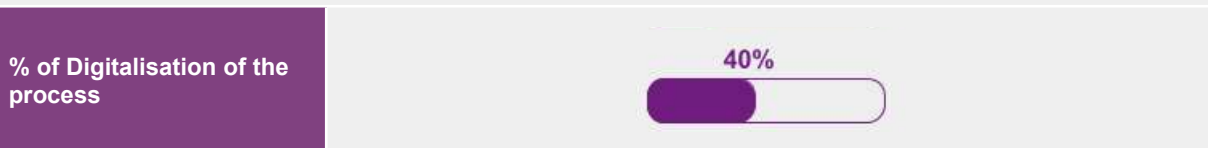
Water quality Monitoring / Laboratory information management system	
Tool	Microsoft Excel, Microsoft Word
Users	-
<p>Uses and Shortcomings</p> <p>Potable water:</p> <p>Three laboratories exist in Bekaa to test the potable water:</p> <ul style="list-style-type: none"> • the main laboratory in Zahle, composed of: <ul style="list-style-type: none"> ◦ 3 laboratory technicians for drinking water; ◦ 1 laboratory technician for waste water. • Sublaboratory in Baalbek (for Baalbek and North Bekaa), no longer in use and needs to be renovated; • Sublaboratory in Chamsine (South Bekaa), preparation and equipment before 2020, but is not currently operating. <p>The water quality is monitored in 3 parts of the process:</p> <ul style="list-style-type: none"> • the source; • the reservoir; • the connection. <p>In theory, 1 daily analysis should be conducted on each source, but due to the difficulty in accessing some sources (lack of fuel), some remote sources are only tested every 3 months. In the best cases, there are 10 to 15 locations tested per day (x 3 samples per location). It takes 48 hours to get the results of all the analyses.</p> <p>The analyses are carried out as follows:</p> <ul style="list-style-type: none"> • Technicians have access to SOPs (either in hard copy at their workstation or in soft copy sent by email) for calibrating the instruments and carrying out the analyses; • After completing the analysis, the laboratory technicians record the result on paper; 	

- This paper is given to the laboratory manager who enters the data into an Excel report, then creates a Word file with the analysis and recommendations;
- Due to the lack of internet connection on site, the reports (Excel and Word) are given via USB stick to the Station Head of Section.

It should be noted that at the time of the visit, the head uses his personal computer to produce the reports, as his work computer has crashed. Despite having made a request to the IT team, there is currently no replacement equipment.

Waste Water:

The laboratory for testing wastewater from the wastewater treatment plants (Zahlé, Jebjanine Saghbine and laa) is located in Zahlé - Haouch El Omara.
 The laboratory was not visited during the mission.



Monitor network performance

Tool	Whatsapp
Users	-

Uses and Shortcomings

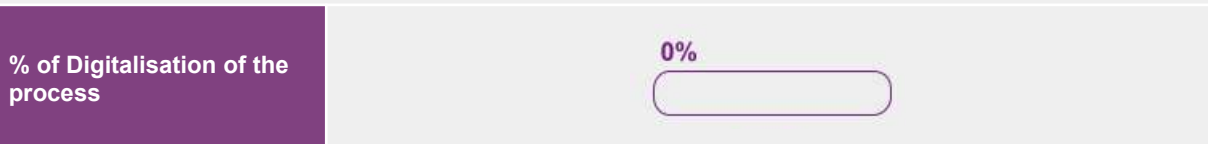
The performance of the network is in theory assessed by regularly calculating the volumes distributed and invoiced. In a more detailed approach, the volumes pumped by sector and the effect of leak repairs on the volume introduced need to be monitored and analysed.

However, in the case of BWE:

- **No report is requested on a regular basis by the Direction;**
- For some stations in Zahle, spreadsheets with volume/flow and energy are sent to the Head of Department;
- In most cases, if figures are needed regarding the production volume, the calculation is an approximation based on the characteristics of the pumps, and the number of working hours (sent to the Head of Department by Whatsapp). However, this method is not really reliable as electricity is discontinuous.

Thus, due to the lack of systematic data collection and reporting procedures, it is impossible for BWE to really monitor its network performance, which triggers several issues:

- BWE is dependent on customer complaints and potential rounds carried out to detect service degradations;
- Operational and technical teams operate "blindly", which prevents them from directing their efforts towards high-impact actions.



2.2.4. SUMMARY

The digitization assessment of sub-processes can be summarised as shown below. It is important to note that this representation does not define digital maturity, but it contributes to the overall understanding of the role of digitalization in the business.

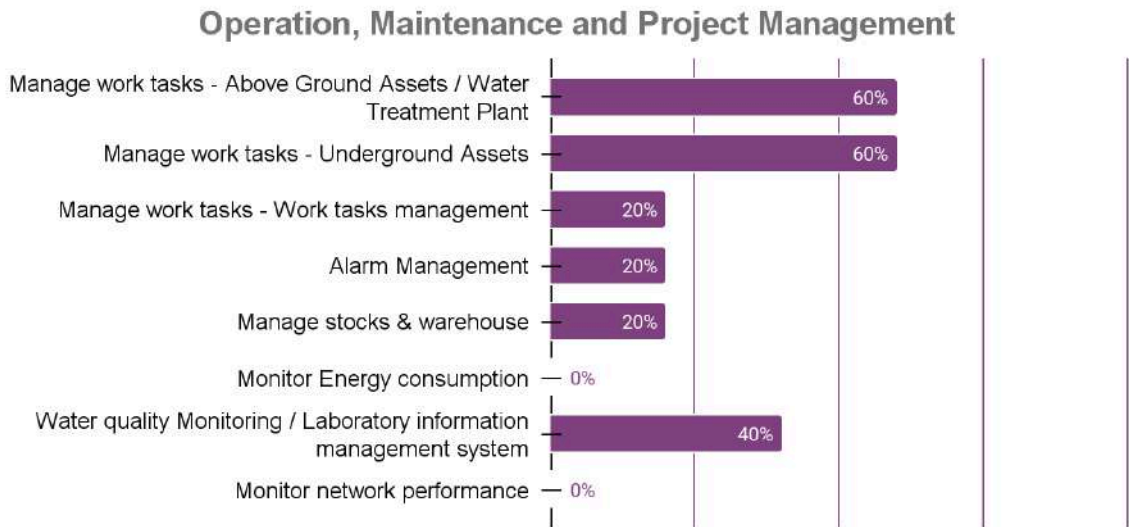


Figure 14: Digitalisation overview of O&M subprocesses

2.2.5. SWOT

Based on the initial mission diagnostic, the SWOT matrix below displays the key elements of the diagnostic performed at a department/unit level:

Strengths	Weaknesses
<ul style="list-style-type: none"> Existing SCADA to operate remotely 30% of the installations; Existing laboratory SOPs; Traceability culture regarding the water quality management (regular reporting). 	<ul style="list-style-type: none"> Lack of tracking and reporting: <ul style="list-style-type: none"> Asset management (no inventory); Intervention; Production; Energy consumption. No digitised process (maintenance, customer new connections); No updated inventory of AG Assets; No asset lifecycle monitoring (even in paper form).
Opportunities	Threats
<ul style="list-style-type: none"> SCADA being extended step by step to ultimately control all BWE installations; Report being created in the SCADA to track production and consumption; 	<ul style="list-style-type: none"> The mobilisation required to integrate sanitation facilities could interfere with the implementation of digitalisation measures.

<ul style="list-style-type: none"> • Existing GIS, but there is a need to improve the way information (new installation or network) is transmitted; • Data quality integrated in the GIS but no use of this information. 	
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2.2.6. MAIN RECOMMENDATIONS

The diagnosis of the level of digitalisation of the process has led to a number of recommendations, categorised as:

- “organisation”: reorganisation of teams, cross-team communication, clarification of task allocation, recruitment, etc;
- “skills”: training to be provided;
- “tools”: need for new software or hardware, licences, software improvements, etc;
- “processes”: formalisation of new processes, revision of processes with shortcomings, etc.

These recommendations are prioritised as follows:

- 1 - High priority: action to be addressed in the 1st coming year;
- 2 - Medium priority: action to be addressed in the 3 coming years;
- 3 - Low priority: action to be addressed in the 5 coming years.

Category	Recommendations	Priority
Organisation	Complete an operational and digital assessment of the future sanitation department recently integrated into the WE	1
Skills	Introduce the digital culture (training), with priority given to district operations teams	1
Tools	Implement a CMMS module within the ERP (as it has been done in SLWE)	2
Processes	Implement a reporting culture by imposing standard regular reports on operations: daily production, etc.	1
	Make the GIS more largely available for the different departments (maintenance, operation...)	1
	Make an inventory of mandatory procedures (e.g. parts management) and remove superfluous paper circuits	2
	Implement a minimal culture of traceability (e.g. excel form on a shared drive) for: <ul style="list-style-type: none"> - Asset inventory; - Asset logs; - ... 	1

	Implement SOPs to update AG assets information in the GIS	1
	Implement SOPs to update water quality information in the GIS	2

Table 6: List of O&M business process recommendations

2.3. Focus on SCADA

In parallel to the digital assessment of BWE, a focus on the SCADA has been done on the utility. This diagnosis covers the functionalities Control, Data Acquisition and Supervision of infrastructures, while taking into account the operational and IT contexts.

After an introduction on the key notions of this technical field, the current SCADA team organisation is presented and reviewed.

2.3.1. INTRODUCTION TO SCADA

The Supervisory control and data acquisition (SCADA) is a system of software and hardware elements that allows industrial organisations to:

- Control industrial processes locally or at remote locations;
- Monitor, gather, and process real-time data;
- Directly interact with devices such as sensors, valves, pumps, motors, and more through; human-machine interface (HMI) software;
- Record events into a log file.



The SCADA system is crucial for water utilities to improve or maintain operation efficiency by processing data for smarter decisions, and communicating system issues to help mitigate downtime.

The figure below provides an overview of the different functional and application levels of information systems dedicated to any Water utility operations as presented by the International Standard Approach ISA-95. The ISA95 is used to develop an automated interface between business and control systems. This standard was initially developed for global manufacturers and aims to provide a consistent terminology used as a foundation for supplier and manufacturer communications, while providing consistent information and operational models. There are 5 main hierarchical levels:

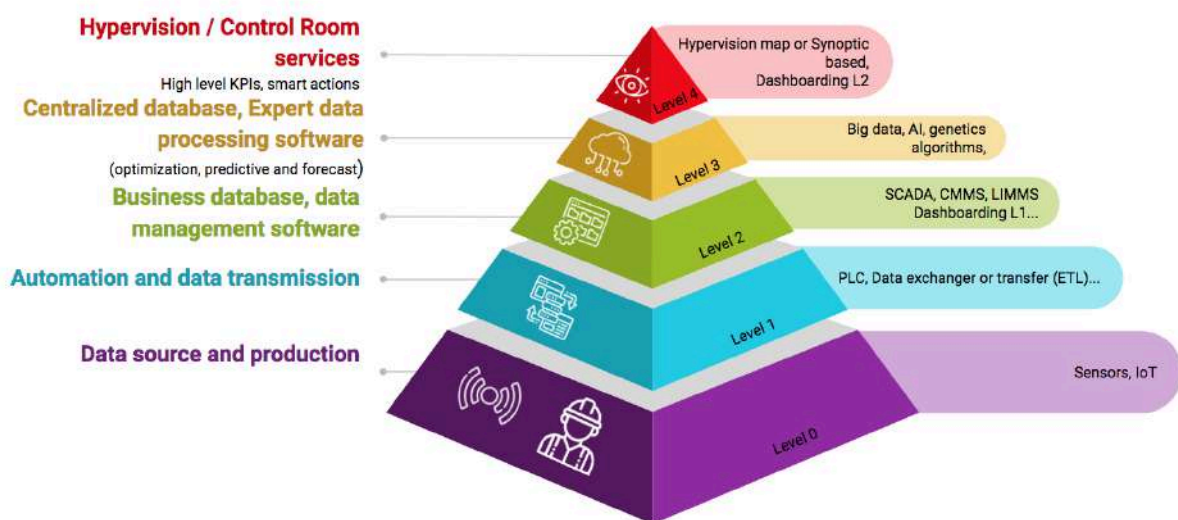


Figure 15: Computer Integrated Manufacturing (CIM) Approach (ISA-95)

Data is generated from level 0 (instrumentation, sensors, etc.) and processed by successive higher functional levels in order to support operational decision-making.

The levels referred to are:

- **Level 0:** Sensors and physico-chemical analysers, directly interfaced with the process which provide the exchange of information with the equipment installed on Level 1;
- **Level 1:** Programmable Logic Controllers (PLCs), Control Process Units (CPUs), Operator terminals, local supervision software, which ensure the operation of different functional process units;
- **Level 2:** SCADA System - Centralised supervision system that ensures monitoring, supervisory control and piloting of the whole installation of a production and its remote structures, through a HMI (Human Machine Interface);
- **Level 3:** It is composed of the Manufacturing Execution System (MES), archiving systems, support of resources and production optimization systems (historian, reporting tools, etc.) and links the corporate IT systems and the control systems (levels 1 & 2);
- **Level 4:** Enterprise Resource Planning (ERP) that manages the overall functions of the enterprise. This level is also named "Hypervision".

The operation of SCADA equipment is key for any water production utilities. The SCADA team is in charge of maintaining and improving the SCADA system, including the instrumentation. The SCADA team is in constant communication with the IT department, as the SCADA data feeds the ERP system, which falls under IT department.

2.3.1.1. OPERATION TECHNOLOGY (OT)

SCADA is classified as part of the Industrial Control System (ICS) in the Operational Technology domain as opposed to Information Technology (IT) domain. The Industrial internet of thing (IIoT) is in between the two domains with the Industrial internet of thing is a subdivision of the IoT within the OT.

While the two domains shared common technologies and equipment, their purposes differ:

- OT has to ensure the operation continuity of the production tool. Especially in water utilities where any stoppage in production could lead to water outage. The OT must also ensure the safety of people and property during their work;
- IT, on the other hand, aims to centralise data and processes and ensure their protection.

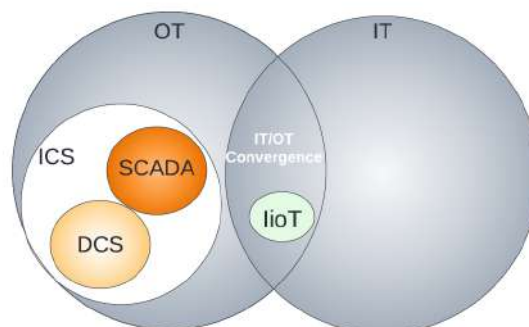


FIGURE 16: SCADA, ICS, OT, IT

2.3.1.2. IT/OT CONVERGENCE

Water Utilities are always looking to improve efficiency and effectiveness by converging, or at least linking, their technical and information systems. The difficulties inherent in such a strategy include governance, management of connected equipment, cyber security, data sharing, etc. In addition to these "technical" challenges, the main issue to overcome is the sharing of common objectives and the understanding of the respective constraints between OT and IT.

To achieve this convergence, companies are increasingly adopting a wide range of technologies. These include: Ethernet IP or WiFi networks, system virtualisation, client/server architectures, ETL (Extract Transform Load) type tools, and more recently the Cloud, Big Data, IoT objects, LPWAN networks, augmented reality or Machine Learning. Industrial computing technologies are also increasingly being adopted, with communication protocols promoting interoperability between IT and OT systems, such as OPC-UA based on the principles of web services.

IT/OT convergence is one of the pillars necessary for the development of Industry 4.0, also called Factory 4.0, is an industry augmented by new strategic approaches driven by new technologies.

The core of Industry 4.0 is inter-system connectivity, such as OT and IT. In this new industry, different systems and processes communicate with each other. Many technologies support the exchange of information, and one of the main ones is the Internet of Things.

A mobile approach allows you information from mobile terminals (smartphones etc.) to be used in responding to the challenges of field interventions. It also provides operatives with much better information (complete, precise and up to date) to make their work more efficient and effective.

The establishment of an integrated information system, between IT and OT, but also within IT, allows the future development of CIM level 3 and 4 expert systems (see figure 14). This requires strict compliance with cybersecurity rules right from the initial design of the systems.

2.3.1.3. PURPOSE OF A SCADA TEAM

A SCADA team is in charge of maintaining and improving the SCADA system, including the instrumentation. It is primarily related to Operation and Maintenance activities. Also, part of the SCADA infrastructure can be linked or even put in common with IT processes, mainly server hosting and communications networks. Therefore SCADA responsibilities can be shared between Operations and IT.



Figure 17: Industry 4.0

2.3.2. CONTEXT AND ORGANISATION OF BWE REGARDING SCADA

The human resources available for SCADA subjects at BWE is partly external.

Resources for SCADA operations

The sites are mainly operated in Remote-Manual mode as the Local mode is password protected. When in remote-manual, operations are done from the control room by a SCADA operator. This staff is present in the control room during regular hours only and there is no on-duty service in case of operation required during off the clock hours. In this case, the O&M staff has to find ways to bypass the PLC electrically to operate the equipment (e.g. start a well pump).

Resources for SCADA maintenance

Maintenance and troubleshooting is also carried out by a subcontractor (see below), supported by two or three Electromechanical technical staff among each branch. These staff are not trained on SCADA maintenance.

2.3.3. BWE MAIN SCADA

2.3.3.1. IMPLEMENTATION

Project organisation

As part of a Memorandum of Understanding between the Swiss Development Corporation (SDC) and BWE, a technical assistance was performed to finance the implementation of some parts of the SCADA. **The SDC contracted a consulting company for the general design and specifications, Rafik El-Khoury & Partners, and a private integrator company for the implementation, Modon.** The design was done in 2016 and the implementation started in 2018 with 2 consecutive phases.

The Main SCADA implementation is part of a larger project conducted by Modon for BWE. **The contractor is in charge of the revamping of all electrical, instrumentation and control equipment.** Having the same contractor working on these three topics is a positive aspect as he will ensure coherence between the power equipment and control equipment.

Before the beginning of the implementation, a complete field audit was conducted by Modon to properly evaluate the existing equipment. This phase gave the opportunity to confirm the financial proposal of the contractor and, if necessary, adjust it for some sites.

The whole implementation and system maintenance is managed by **a single Automation Engineer** at Modon, who is also involved in the SCADA implementation for SLWE.

Modon also participates in SCADA operations by providing the **SCADA operators** to SLWE.

Phasing

The project then rolled out according to a phased implementation. The phasing allow to implement strategically the control equipment, while taking into considerations various aspects:

- Budget availability;
- On-going construction works on the facilities and network;

- Organisation of operational teams;
- Facilities that need to be connected through SCADA.

Phase 1 of implementation consisted in the **supply and setting up of the SCADA equipment for 43 sites, completed in 2019**. This phase includes the furniture of all the Control room, Server room and Local Control equipment.

Phase 2 includes the **maintenance of the SCADA**, some upgrades to existing equipment and **the addition of 11 new sites to the supervision system**.

The 2 phases address 64 sites among around 150 sites of the scope of the establishment (~30%).

Modon is currently rolling out phase two of the implementation by adding 11 more sites to the central supervision. Also some other functionalities are being implemented, such as the reporting tool allowing users from a workstation in the control room to generate reports.

2.3.3.2. CONTROL STRATEGY

Currently, sites are functioning only a few hours per day due to the lack of energy. The pumps (normal pumps and chlorination pumps) are in use most of the time, when they have enough energy to run. They do not follow any planned schedule, but do their best to evenly distribute water to customers.

The PLCs are programmed to allow three operating modes:

- Local Mode: preferred for site maintenance, no automatic start of pump;
- Remote - Manual Mode: manual start of pumps from the control room;
- Remote - Automatic Mode: automatic start of pumps according to the logic incorporated in the pumps.

The switch between Local and Remote mode is driven by a physical selector on the cabinet. This status is then available on the central supervision, and on local HMI.

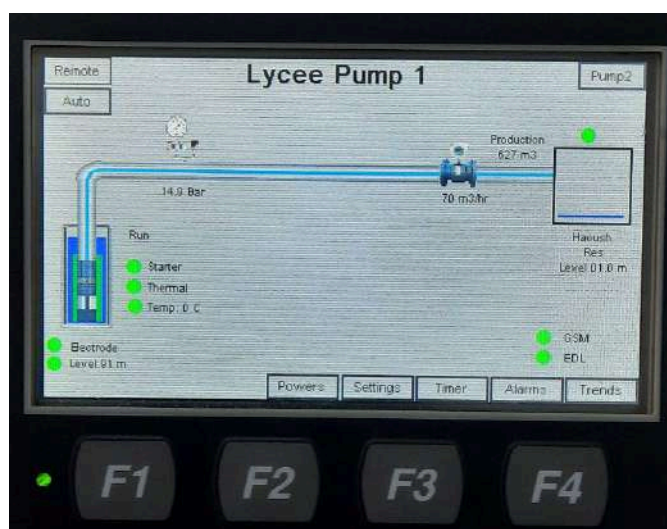


Figure 18: Main screen of a well with pumping station

The Electromechanical technical staff are able to consult these HMIs. They can easily understand the information available on cabinets and HMI. However, they do not have the credentials (passwords) to modify settings of an installation. As explained before, operators sometimes have to bypass the controller to implement the command electrically.

2.3.3.3. EQUIPMENT USED

General architecture

The Main SCADA system is composed of a Central Control Room, in Zahle offices, and multiple distant units for on-site automation. The different sites are connected through a wireless network. Local communications are through Ethernet cables.

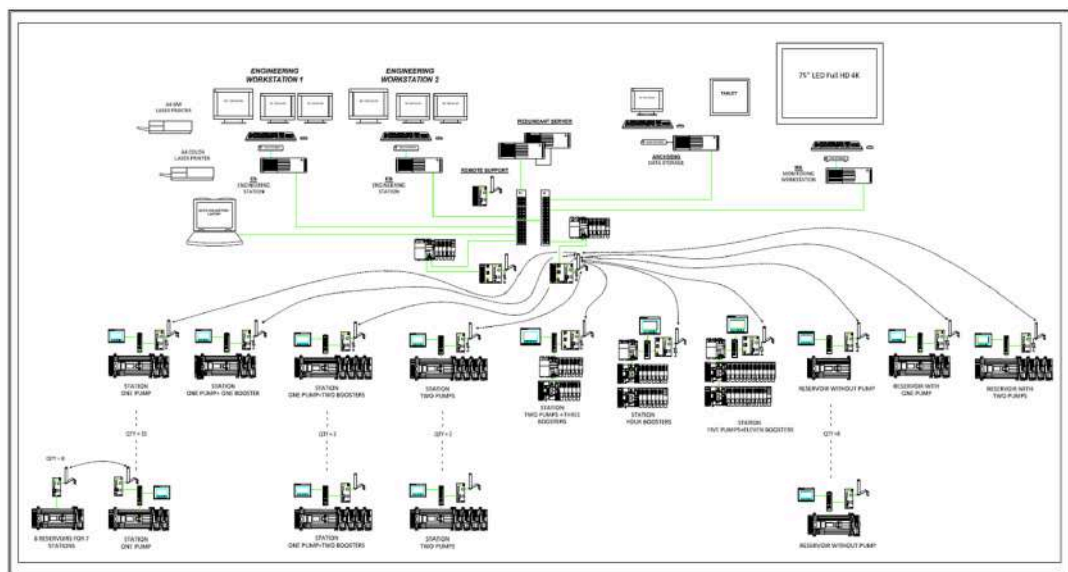


Figure 19: Simplified architecture of the existing SCADA system

The architecture allows redundancy of the supervision with two servers and two communication gateways on Zahle main office. The servers host the necessary software on virtualized machines:

- Factorytalk View studio (Supervision software);
- Factorytalk Historian;
- VMware;
- Veeam backup.

Monitoring and control equipment

In general, the distant sites have a typical control cabinet composed of:

- A PLC and extensions (Rockwell);
- A Human Machine Interface (HMI) to display reading values and to control the operation (Rockwell);
- A Communication Gateway with antenna (Prosoft);
- A switch (Rockwell);

- Power supply (Rockwell).

In some cases, when many equipment are in the same location a single CPU is used for several control cabinets using distributed IOs

Level 1 equipments are detailed below:

Type	Brand	Typical model used
PLC	Rockwell	Micrologix 1400
IO	Rockwell	MicroLogix 1762-IFxx Analog Input Module MicroLogix 1762-IQxx DC Input Module
Switch	Rockwell	Stratix 2000 Ethernet Unmanaged Switches
Communication Gateway	Prosoft	Ethernet and Serial Industrial Cellular Gateway ICX35-HWC
Human Machine Interface	Rockwell	PanelView 800, 10.4 in HMI Terminal
Power supply	Rockwell	Power Supply XLE 120 W Power Supply

Table 7: Level 1 equipments



Figure 20: Typical layout of a control cabinet

Among facilities equipped with SCADA equipment, some of them were subject to vandalism. Controllers or instrumentation were stolen or damaged. Seureca recommends securing the access to control equipment in order to prevent such issues.

SCADA control Room:

The control room is located in Zahle main office. The room is secured with an electromagnetic lock with a biometric reader. Three workstations are available to operate SCADA, one of which is linked to a large screen. A printer is available for reports.

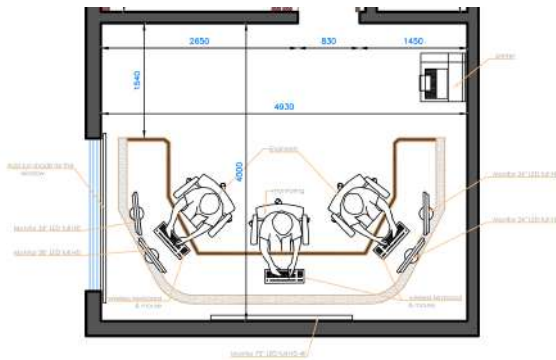


Figure 21: Layout of the control room in Zahle

Factorytalk Client is installed on the workstations to access the supervision. The available functionalities are the following:

- Synoptics and real time dashboards;
- Alarms and Events logs;
- General Trends;
- Status overview (Physical status, and communications status) for facilities and Control room.

Factorytalk vantagepoint (running with Microsoft Excel) is also installed on at least one workstation, to configure and export reports from the Historian. The reports are currently being configured by Modon.

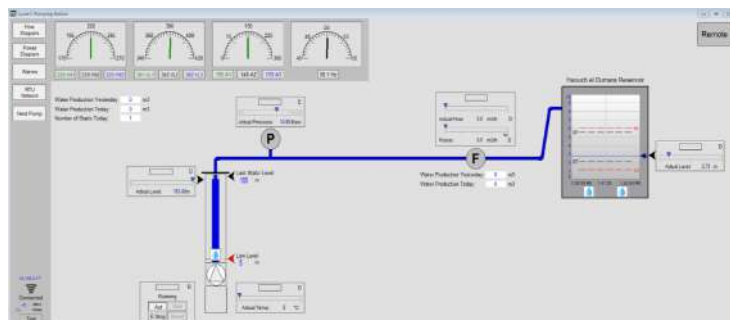
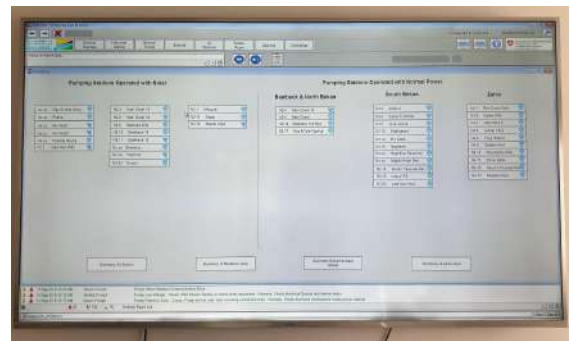
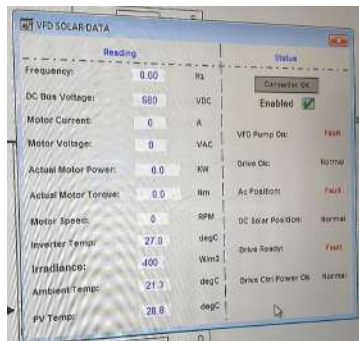


Figure 22: Example of views available in the central supervision

Alarms management:

A view in BWE main SCADA is dedicated to alarm management. The view contains a table of alarms, their status and date/time information. The alarms are generated by supervision software using inputs from PLCs. Usual Acknowledgement functionalities are available.

Severity	Event Time	Alarm Name	Condition N.	Message	Alarm Class
1	7/21/2023 1:26:05 PM	Saghtone_Pump 1 High Voltage	TRIP	Pump High Voltage - Cause: Bad Source Quality or Alarm limits exceeded - F...	Electrical Voltage ..
1	7/21/2023 1:12:23 PM	Saghtone_Pump 1 Failed to Start	TRIP	Pump Failed to Start - Cause: Pump did not start after receiving command order...	Pump Starter Fault
1	7/21/2023 1:12:23 PM	Saghtone_Pump 1 Run Output Command Issued	TRIP	Pump Run Output Command Issued	Operation Event
1	7/21/2023 12:51:24 PM	Cours_Pump 1 Power Meter Connection Error	TRIP	Power Meter Modbus Communication Error	Electrical Current F...
1	7/21/2023 12:50:27 PM	Chouzaïle_Pump 1 Low Current	TRIP	Pump Low Current - Cause: Pump Discharge observed, No Load, Pump Wrong dir...	Electrical Current F...
1	7/21/2023 12:50:27 PM	Chouzaïle_Pump 1 Low Frequency	TRIP	Pump Low Frequency - Cause: Bad Source Quality or Alarm limits exceeded - F...	Electrical Frequen...
1	7/21/2023 12:50:18 PM	Saghtone_Pump 1 Low Frequency	TRIP	Pump Low Frequency - Cause: Bad Source Quality or Alarm limits exceeded - F...	Electrical Frequen...
1	7/21/2023 12:48:42 PM	EnZabab_Pump 1 Making Completed	TRIP	Pump Making Completed	Operation Event
1	7/21/2023 12:47:42 PM	EnZabab_Pump 1 Running	TRIP	Pump Running	Operation Event
1	7/21/2023 12:47:42 PM	EnZabab_Pump 1 Failed to Start	TRIP	Pump Failed to Start - Cause: Pump did not start after receiving command order...	Pump Starter Fault
1	7/21/2023 12:47:41 PM	EnZabab_Pump 1 High Voltage	TRIP	Pump High Voltage - Cause: Bad Source Quality or Alarm limits exceeded - F...	Electrical Voltage ..
1	7/21/2023 12:38:52 PM	EnZabab_Pump 1 Run Output Command Issued	TRIP	Pump Run Output Command Issued	Operation Event
1	7/21/2023 12:32:49 PM	EnZabab_EDL is ON	TRIP	EDL Source ON	Operation Event
1	7/21/2023 12:32:49 PM	Saghtone_EDL is ON	TRIP	EDL Source ON	Operation Event
1	7/21/2023 12:29:54 PM	EnZabab_Pump 1 Safety Run Output Command Issued	TRIP	Pump Run Output Command Issued	Operation Event
1	7/21/2023 12:29:54 PM	Saghtone_Pump 1 Safety Run Output Command Issued	TRIP	Pump Run Output Command Issued	Operation Event
1	7/21/2023 12:21:25 PM	Gazca_Pump 1 Low Frequency	TRIP	Pump Low Frequency - Cause: Bad Source Quality or Alarm limits exceeded - F...	Electrical Frequen...
1	7/21/2023 12:21:25 PM	Gazca_Pump 1 Low Current	TRIP	Pump Low Current - Cause: Pump Discharge observed, No Load, Pump Wrong dir...	Electrical Current F...
1	7/21/2023 12:21:14 PM	Gazca_Pump 2 Running	TRIP	Pump Running	Operation Event
1	7/21/2023 12:16:49 PM	Alkhal_Pump 1 High Voltage	TRIP	Alarm fault cleared: Alarm input quality is good	Electrical Voltage ..
1	7/21/2023 12:16:49 PM	Alkhal_Pump 1 Running Hours Exceeded	TRIP	Pump Running Hours Exceeded - Cause: N/A - Remedy: Perform a regular maint...	Pump Warning
1	7/21/2023 12:12:44 PM	Gazca_Pump 1 Low Voltage	TRIP	Pump Low Voltage - Cause: Bad Source Quality or Alarm limits exceeded - F...	Electrical Voltage ..
1	7/21/2023 12:12:34 PM	Gazca_EDL is ON	TRIP	EDL Source ON	Operation Event
1	7/21/2023 11:55:33 AM	EnZabab_Pump 1 Low Voltage	TRIP	Pump Low Voltage - Cause: Bad Source Quality or Alarm limits exceeded - F...	Electrical Voltage ..
1	7/21/2023 11:25:30 AM	Saghtone_Pump 1 Low Voltage	TRIP	Pump Low Voltage - Cause: Bad Source Quality or Alarm limits exceeded - F...	Electrical Voltage ..
1	7/21/2023 11:11:03 AM	Cours_Pump 1 Making Completed	TRIP	Pump Making Completed	Operation Event
1	7/21/2023 11:10:51 AM	Fluck_River 1 Running	TRIP	River Running	Operation Event

Figure 22: Alarms view in the supervision

Alarm Message	Ack Status	Alarm IN	Acknowledge Data	Alarm OUT	Inactive Date
Pump 2 Failed to Start	NotAcked	10:46:31	---	10:48:11	9/12/2023
Pump 1 Failed to Start	NotAcked	9:05:26 PM	---	9:05:01	9/12/2023
Pump 2 Failed to Start	NotAcked	9:02:32 PM	---	9:04:51	9/12/2023
Pump 1 Low Frequency	NotAcked	1:56:43 PM	---	1:57:30 PM	9/12/2023
Pump 2 Low Frequency	NotAcked	1:56:42 PM	---	1:57:00 PM	9/12/2023
Pump 1 Low Frequency	NotAcked	10:58:21	---	10:59:21	9/12/2023
Pump 2 Low Frequency	NotAcked	10:58:21	---	10:59:21	9/12/2023
Pump 1 Failed to Start	NotAcked	10:11:21	---	10:11:41	9/12/2023
Pump 2 Failed to Start	NotAcked	10:11:21	---	10:13:01	9/12/2023
EDL Fault	NotAcked	10:00:21	---	10:01:01	9/12/2023

Other alarms are generated directly by the PLC for on-site display.

Figure 23: Alarms view on the local HMI

Power supply and monitoring for Main SCADA equipment:

The region faces frequent power outages for the main office and the distant sites. To ensure better availability of the data for the control room, these methods are used:

- The servers are equipped with UPS, allowing the supervision to stay active for a few hours in case of power outage;
- The distant sites are equipped with solar panels for low voltage supply, allowing control equipment to remain active and give the information of power outage to the control room.

Power supply availability, characteristic and consumption can be monitored from the main SCADA control room, thanks to power measuring units on pumps and utilities energy supply (Diris A-20 seen on power cabinet).

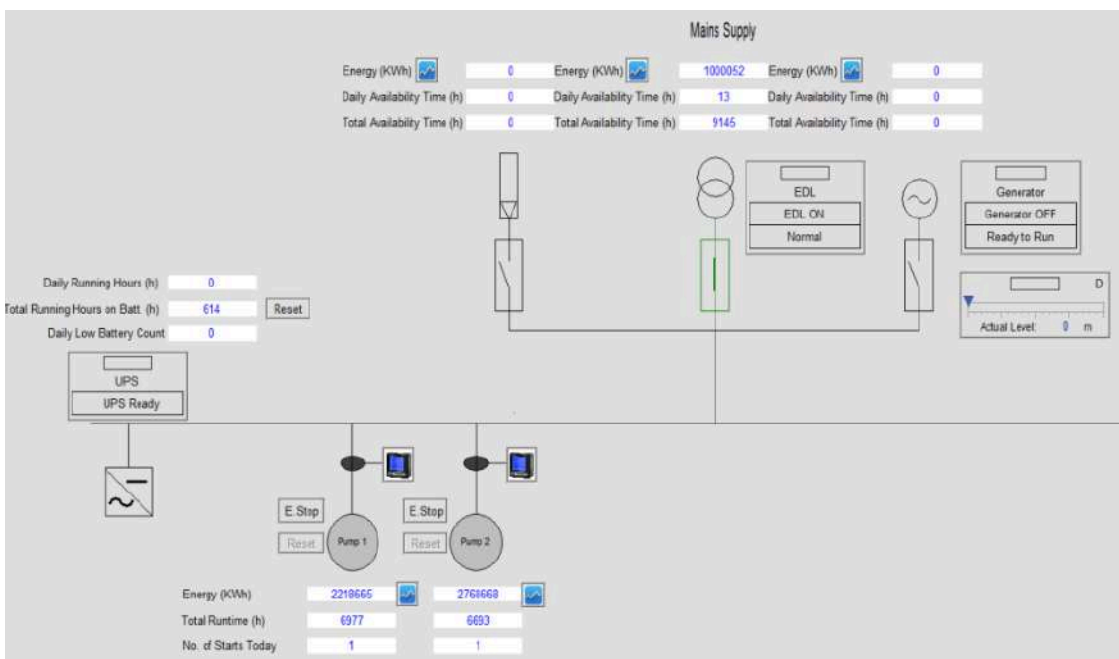
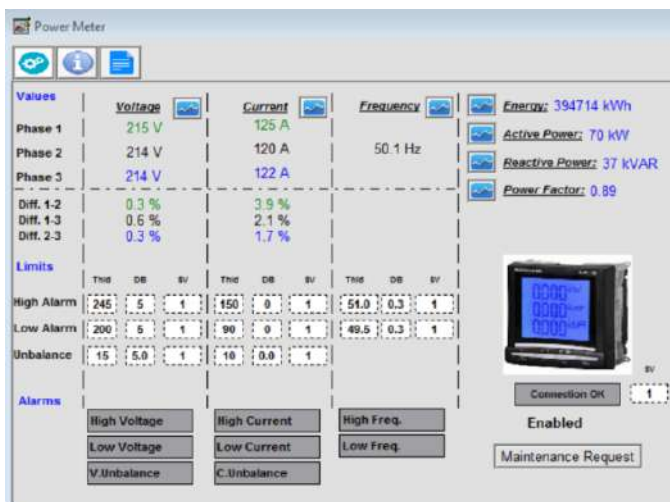


Figure 24: Power diagram for a pumping station in the supervision



Seureca estimates that the data displayed from power meters is very extensive. SCADA operators do not need this level of detail to conduct daily operations. However, it is good to store this historical data for future electrical studies.

Figure 25: Power supply data available in the supervision

2.3.4. TREATMENT PLANT LOCAL SCADA

During the on-site mission, SEURECA took a closer look at the Zahle site which is a treatment plant receiving water from a source (no wells).

The treatment plant is equipped with a Schneider PLC (Modicon TSX Micro). The three filters are equipped with individual control desks to command the backwashes. The other equipments are controlled manually using buttons on power cabinets. The control part is partially maintained as the maintenance requires skills and budget.



Figure 26: Controller and control desk available on Zahle WTP

Currently no HMI is available beside two synoptic with status LED (see figure below).

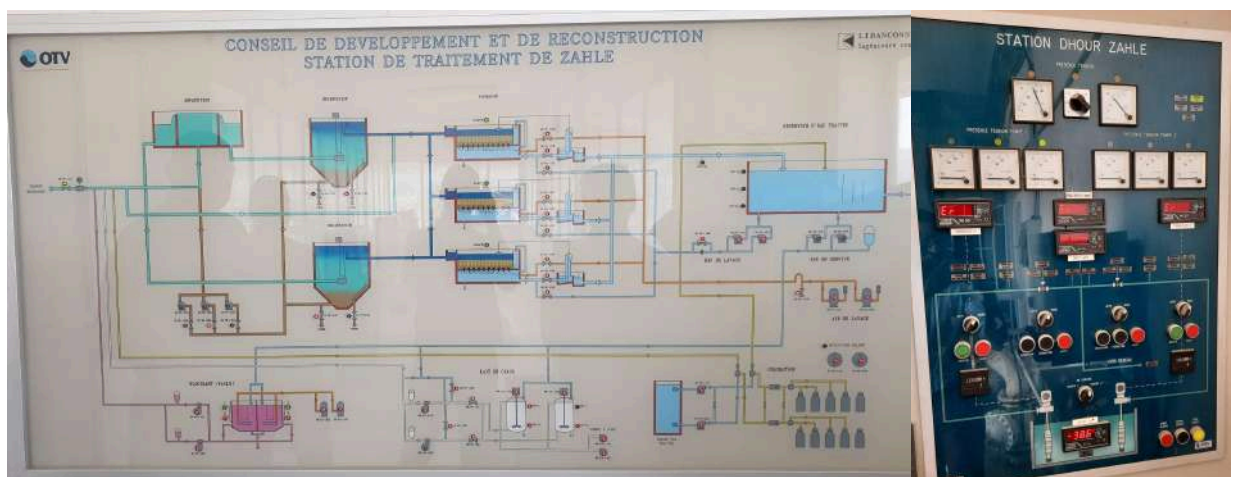


Figure 27: Synoptics and Control desk of the Zahle WTP

The on-site engineer and operators showed a will to integrate this facility into the central supervision. As this site is a complex and critical asset, this will require a detailed audit (from Modon for eg.) to properly design and quote the necessary work.

2.3.5. SMART METERING

Some smart bulk meters are used on the establishments network. These meters, from Itron, are sending data to a server which is accessible through a desktop software in Zahle office. There used to be periodic reports based on this data, but it is no longer the case. Modon could not integrate these bulk meters into the supervision, therefore they are now being replaced progressively for another manufacturer.

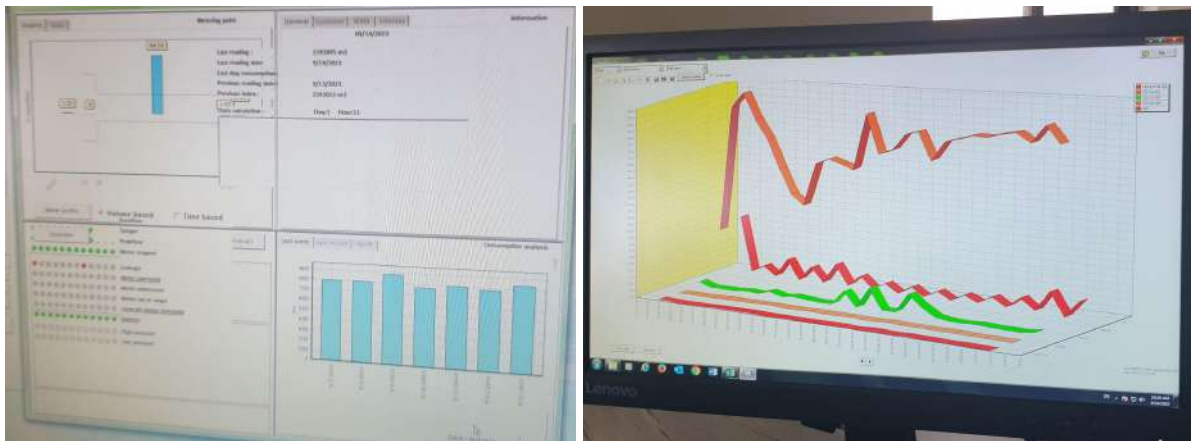


Figure 28: Reporting available in Itron platform for bulk meters

2.3.6. SWOT

Based on the initial mission diagnostic, the SWOT matrix below displays the key elements of the diagnostic performed at a department/unit level.

Strengths	Weaknesses
<ul style="list-style-type: none"> Existing well established strategy for Main SCADA implementation; Existing SCADA in service; 	<ul style="list-style-type: none"> Few skills in automation available in the Establishment; SCADA operators working hours not compatible with the current centralised control management;
Opportunities	Threats
<ul style="list-style-type: none"> Existing MoU with a donor allowing future project related to SCADA; Motivated technical staff to improve SCADA topics, even if they do not have automation knowledge. 	<ul style="list-style-type: none"> Remote access to Main SCADA (cybersecurity threat); Major part of the knowledge of the Main SCADA infrastructure possessed by MODON; Only one automation expert in Modon.

2.3.7. RECOMMENDATIONS FOR SCADA IMPROVEMENT

2.3.7.1. GENERAL RECOMMENDATIONS

Based on the diagnostic above, some recommendations can be made for SCADA overall improvement.

BWE Main SCADA infrastructure is well designed and follows a good strategy to permit future deployments. A few issues were identified leading to the following recommendations:

- Technical recommendations:
 - Optimise the number of IOs to be send to the central supervision;
 - Integrate bulk meters data into the SCADA;
 - Strengthen the security of the system, especially the remote access (add a secure access to data through DMZ, remove the remote access, etc.);
 - UPS for servers are currently positioned in a non secured place. They should be moved to the server room or another secured room,
 - Protect existing control equipment against vandalism.
- Organisational recommendations:
 - Establish an operational strategy defining:
 - General rules for equipment start and stop;
 - Roles of operators;
 - Preventive maintenance;
 - Structured on-call duty from internal staff and external automation contractor;
 - Cybersecurity;
 - Train two electrotechnical staff per branch to do SCADA maintenance;
 - Secure automation skills for the establishment by either hiring/train a referent on SCADA topics;
 - Ensure that the automation contractor has enough resources to support BWE for implementation and O&M;
 - Conduct a cybersecurity audit to identify potential threats.

2.3.7.2. RECOMMENDATIONS PRIORITIES

The above recommendation can be categorised as:

- “organisation”: reorganisation of teams, cross-team communication, clarification of task allocation, recruitment, etc;
- “skills”: training to be provided;
- “tools”: need for new software or hardware, licences, software improvements, etc;
- “processes”: formalisation of new processes, revision of processes with shortcomings, etc.

These recommendations are prioritised as follows:

- 1 - High priority: action to be addressed in the 1st coming year;
- 2 - Medium priority: action to be addressed in the 3 coming years;
- 3 - Low priority: action to be addressed in the 5 coming years.

Category	Recommendations	Priority
Organisation	Establish a SCADA operational strategy regarding	1

	Processes, Responsibilities, Maintenance, On-call duty, Cybersecurity, etc.	
Skills	Secure automation skills for the establishment (Hiring or training)	1
	Verify that Modon can mobilise at least two experts for the SCADA implementation, operation and maintenance	1
	Train two electrotechnical staff per branch to do SCADA maintenance	2
Tools	Carry out the planned implementations of SCADA in the next phases	2
Processes	Implement or correct the identified technical enhancements (refer to detail of previous paragraph “General recommendations”)	1
	Implement works and procedures to protect the SCADA system against vandalism and cyber attacks	1-2

Table 8: List of recommendations for SCADA improvement

2.4. CUSTOMER MANAGEMENT BUSINESS PROCESS

2.4.1. MANDATE

In terms of Customer management activities, BWE performed the following tasks:

- New contracts management;
- Revenue collection;
- Customer debt management;
- Customer relations & complaints management;
- Customer information management.

There is currently no formal “billing activity” as BWE does not issue any bill to the clients; however the invoiced amount is monitored at the Finance directorate level, and customers debts are followed up thanks to the customer database.

In 2022, a total of 72 billion Lebanese pounds were invoiced, yet only 32,95% of this amount has been collected to date. This indicates a significant gap between the invoiced amount and its collection. Implementing effective collection strategies, streamlining billing processes, and enhancing communication with customers are some of the key steps to bridge the gap between invoiced and collected amounts.

2.4.2. ORGANISATION

The Customer management activities are divided among two directorates:

- The Financial department:
 - whose “Financial section” is in charge of:
 - cash collection at the office and with cash collectors;
 - cash collection monitoring and reconciliation between customer database and cash desks;
 - calculation of invoiced income for the financial statement;
 - follow-up the debts;
 - customer database management (special updates not authorised in branches, debt negotiation, etc).
- The Human Resources & Customers department:
 - whose “Customer section” is in charge of:
 - manage new contracts;
 - update customer database (for usual operations).
- The Distribution & Maintenance department:

- whose “Distribution & Maintenance sections” takes part in the contracts management technical activities:
 - Receive (through call center) and manage customers complaints;
 - On-the-field assessment for the installation of a new connection;
 - Connection installation, modification or shut off.

BWE has 4 offices to welcome customers, located in Zahle, Baalbek, Jeb Jenin and Hermel.

In addition, BWE has a call centre unit, which is under the secretariat. The hotline office is located in the Zahle office. This unit is the point of entry for customers and non customers. It centralises complaints and requests, and redirects them to the appropriate departments. However in the current situation the monitoring of the progress is not performed due to a lack of communication between the departments.

The overall organisation of customer management activities is presented below:

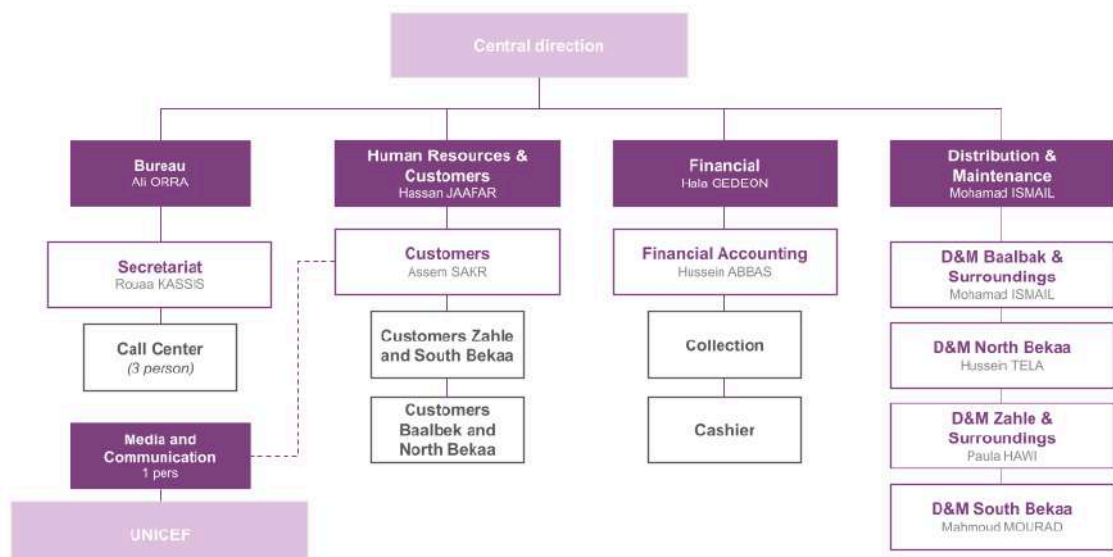


Figure 29: Organisational chart of the departments involved in Customer management business process

Unlike the other water establishments (BMLWE, NLWE and SLWE), the Customer Management business processes are divided among 4 departments.

2.4.3. ASSESSMENT OF SUB-PROCESSES DIGITALISATION STATUS

During the on-site mission, SEURECA took a closer look at the Zahle office dealing with 30,000 registered subscribers.

Based on the interviews and on the on-the-job observations, an assessment of the digital tools used in each sub-processes was carried-out, as presented in the tables below, in order to identified the status of digitalisation of each one and the main shortcomings in the current situation:

Manage new contracts	
Tool	ERP Microsoft Dynamic Navision 2018
Departments involved	Human Resources & Customers department

Uses and Shortcomings

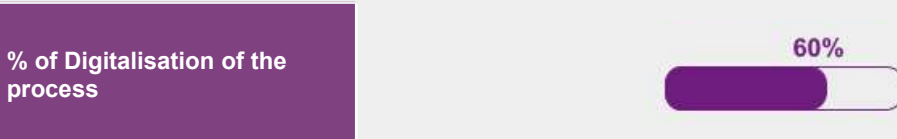
- On average, the Zahle office receives approximately 10 new subscriptions per day;
- To subscribe a contract for water or wastewater with BWE, **the new customer has to come to the office with copies of the required documents for application** → Online applications are not available, but customers can call (the call centre or directly to the branch) to obtain information about the documents that need to be brought to subscribe;



Figure 30: Example of contract application form

- The contract is made on a paper form template (see picture below), then the BWE’s employee fills in with the client at the office. All the application process is then followed on this paper form. This includes the following steps:
 - validation of the application’s completeness;
 - validation of the subscription payment (related to the cost of verification by the O&M team);
 - validation of the information by the O&M inspection team (customer’s connectivity and the surface area of its property) → no digital monitoring of the progress of the required controls;
 - when the customer returns (after a call from the office), validation of payment for the year on a pro rata basis;
 - monitoring of the installation of the new connection by the O&M team → no digital monitoring of the progress of the connections installation.

- In parallel, as soon as the customer provides the completed application form and the required documents, an employee of the branch registers it in the ERP → **the process is completely digitised for the customer management and finance steps**, which does not stop employees from maintaining a paper workflow at certain stages. Note that there are no alarms in the ERP, so process management is based on the paper version that circulates from desk to desk.
- All contracts are archived on paper form at the office and used only in the event of a conflict, as all the information is entered into the ERP system.



Consolidate customer information	
Tool	ERP Microsoft Dynamic Navision 2018
Departments involved	Distribution & Maintenance department

Uses and Shortcomings

- Customer information is consolidated in the ERP Microsoft Dynamic Navision 2018.
- To update customer information, the employees at the branches can only perform basic operations (i.e. change of phone number), on a customer demand.
- At the Zahle office, there is still a large register with the archive of past customers. This register is kept because it seems that some fields are missing in the ERP → To simplify the process and maintain only one data source, it is essential to integrate the data into the ERP, even if it means updating ERP to add the missing fields.
- Customer follow up is not homogeneous across the different regions. At Hermel, for example, there was a power outage for 2 months, preventing computerised monitoring (ERP update) of subscriptions, payments, etc.

CRP1 project:

The CRP1 (Customer Relation Portal - Phase 1) project was started in 2021 in Zahle to update and validate the database by carrying out a door-to-door campaign using tablets to validate customer information (7000 customers have been checked). Due to the difficulty to integrate the data collected into the ERP, the project was not extended and was therefore stopped.

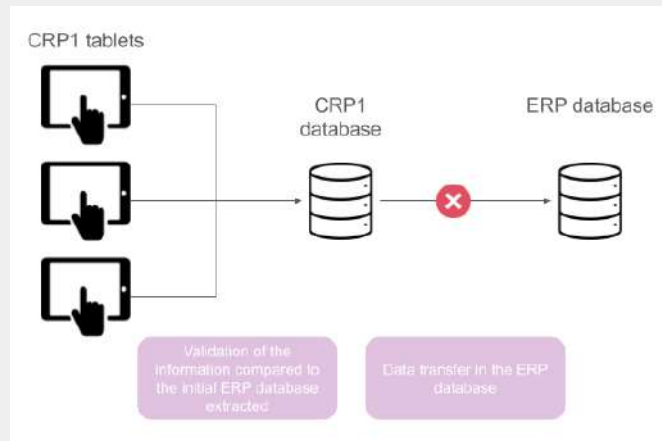
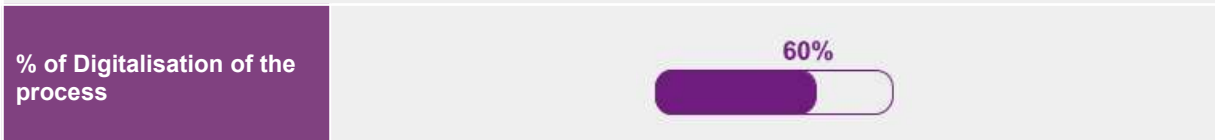



Figure 31: Dataflow state of the CRP1 project



Manage billing	
Tool	ERP Microsoft Dynamic Navision 2018
Departments involved	-
<u>Uses and Shortcomings</u>	
<ul style="list-style-type: none"> BWE does not issue proper invoices based on volumes to their customers. The yearly tariff is assigned, based on the diameter of the gauge and the tariff grid. A bill is sent by mail to all customers in February, and the customer has the whole year to pay the bill. The ERP automatically consolidates the monthly amount invoiced, enabling rigorous monitoring. When a new customer registers, a pro rata invoice is issued. This invoice is first produced in the ERP system, then manually rewritten on yellow carbon paper and transmitted to finance. 	
% of Digitalisation of the process	<div style="text-align: center;">40%</div> 

Manage revenue collection	
Tool	ERP Microsoft Dynamic Navision 2018
Departments involved	-
<u>Uses and Shortcomings</u>	
<ul style="list-style-type: none"> BWE offers 3 channels of payment: <ul style="list-style-type: none"> cash; check; OMT. <p>The Zahle office employs 55 permanent collectors and 12 temporary ones.</p> <p>Collection process:</p> <ul style="list-style-type: none"> Each collector has a large paper register listing all the customers to be collected in alphabetical order; They go door-to-door to collect the money. When a customer pays, he provides a manual carbon receipt to the customer and keeps a copy; When he returns from his round, he fills in a paper table connecting each receipt to the associated invoice; This table is checked by the collector manager and then used to update the ERP database. <p>In addition to being tedious, this process can lead to significant sources of error.</p> <p>A project was proposed to introduce the use of tablets for collectors, but their use was not accepted by the collectors → obstacles to change management have to be identified.</p>	

In the event of non-payment, no communication with the customer is made, but the water supply is cut off. Despite the numerous cases of non-payment, this action remains rare → a system to monitor unpaid bills and send out reminders could help to increase the collection rate.

Please refer to the Finance part regarding the reconciliation management process.

% of Digitalisation of the process



Manage customers claims

Tool	ERP Microsoft Dynamic Navision 2018, Microsoft Excel, UAgent
Departments involved	Bureau - Secretariat (Call centre)

Uses and Shortcomings

- A call centre is located in the Zahle HQ, with 3 agents in charge of answering the calls.
- The Uagent (Call Center software) interface does not communicate directly to the ERP, however the employees of the hotline have access to the customer ERP database and can find the customer thanks to the phone number (if registered) or the name.
- The Call Center receives around 10 calls daily, and can face different types of situations:
 - General complaint: a citizen (not necessary a customer) contacts the call centre to inform of an issue (leak in the street etc);
 - Special complaint: a customer contacts the call centre to complain against lack of water or quality issues;
 - Subscription information: agents do not have all the information regarding the subscription requirements, so they direct customers to the offices in the appropriate area;
 - Balance: customers can call to find out the amount of their bill/debt. The information can easily be provided by the agent, who has access to the ERP system.
- Regarding the complaints, the process is the following:
 - The agent collects the complaint, enters it directly in the ERP, and an automatic field is completed with the name of the person in charge of the zone.
Note that complaints are only taken into account if the customer has paid their invoices;
 - A duplicate message is sent via Whatsapp to the assigned person to speed up the process (sent via a tablet);
 - Once the problem has been reported, the maintenance team cannot update the ticket because of the lack of hardware (no computer and no access to the ERP);
 - No call is made by the maintenance team to confirm that the issue has been resolved, so there are 500 complaints still open in the ERP interface;
 - No call is made by the call centre to the customer to confirm that the problem has been resolved.
- Some complaints are made by physical visits to the call centre (10% of cases). The processing is the same as described above.
- An ERP extract is produced every month in Excel and sent to the communications manager

(Unicef). Reports are no more sent to the General Director.

The call centre has a good level of maturity, in terms of its organisation and the ability of its teams to understand customer requests. An improvement in tools, and change management with the operational team, would lead to an improvement in the overall level of service.



Communicate with clients

Tool Facebook

Departments involved -

Uses and Shortcomings

Communication is managed by Unicef, with a well-defined communication strategy.

Sub Category	Description
Call Center Campaign	12 posts promoted for 7 days, once each month - budget 20\$ daily
Mobile App campaign	Targeted Mobile app download in app stores based on keywords Advertise the ability to register a complaint online at anytime, and not just during BWE opening hours
Complaint Display	Install tablets at all BWE Branches and head office
Social Media	Maintenance Posts - Create 10 posts for active maintenance to promote BWE efforts and increase acceptance and trust.
	Water Sources - Pictures - each week take on a water source and talk about its characteristics while incentivising subscriptions
	Subscription Reminder - 1 posts per month Collection Reminder - 1 posts per month
KFW Booklet	Collect All WE Data from KFW project Profiles
	Analyse Data and create info graphic style Complete Book based on table of content proposed by Nabil
KFW Visibility	Create posts for each KFW project

Table 9: Extract from the 2023 communication action plan

To communicate with its customers, BWE uses social media (Facebook) with its own distinctive visual identity. It enables the clients to be aware of:

- Current and upcoming projects;
- Hotline number.



Figure 32: Facebook page of BWE

CRP2:

A website has also been developed (project led by UNICEF) through the project CRP2 (Customer Relation Portal - Phase 2) in order to allow the customer to subscribe online. The project is still on going as the website has not been published yet, but BWE staff does not have visibility on the status of the project.

No client application has been developed to date.

Commercial brochures and flyers were found in boxes stored at the Zahlé water treatment site. However, it appears that they originate from an old communication campaign and are no longer being distributed.



Figure 33: BWE leaflet

% of Digitalisation of the process



2.4.4. SUMMARY

The digitization assessment of sub-processes can be summarised as shown below . It is important to note that this representation does not define digital maturity, but it contributes to the overall understanding of the role of digitalization in the business.



Figure 34: Digitalisation overview of the Customer subprocesses

Important to notice: The apparent high level of digitalisation shows the ability of the water utility to lead customer operation in its ERP software. In reality, there still exists a lot of paperwork such as new customer management due to change management difficulties (culture), lack of training for end users, poor database reliability or minor ERP shortcomings.

2.4.5. SWOT

Based on the initial mission diagnostic, the SWOT matrix below displays the key elements of the diagnostic performed at a department/unit level:

Strengths	Weaknesses
<ul style="list-style-type: none"> • Dedicated module in the ERP; • Presence on social networks with a distinctive visual identity; • Strong Communication Strategy with SOPs; • Functional call centre; • Multiple channels of payments (cash, collector, OMT) to facilitate customer journey. 	<ul style="list-style-type: none"> • Poor customer database reliability (former customers are still recorded in a register, stolen computer - in Hermel); • No regular reports are requested from management; • Silo of the different sections (office for subscription - don't take complaints and call centre manage complaints - can't help for the subscription, even to list the required documents); • No website/information online; • No alarm in the ERP to track debt;

	<ul style="list-style-type: none"> ● Internal processes rely on the paper and not on the existing ERP information.
Opportunities	Threats
<ul style="list-style-type: none"> ● Possible use of email address or SMS for invoicing; ● Improvement of the customer claim management by implementing the feedback loop; ● Ongoing website development. 	<ul style="list-style-type: none"> ● Willingness to keep paper (for subscription, invoice, etc); ● No customer satisfaction follow up; ● Economic crisis in Lebanon, which limits the budget available for BWE.

2.4.6. MAIN RECOMMENDATIONS

The diagnosis of the level of digitalisation of the process has led to a number of recommendations, categorised as:

- “organisation”: reorganisation of teams, cross-team communication, clarification of task allocation, recruitment, etc;
- “skills”: training to be provided;
- “tools”: need for new software or hardware, licences, software improvements, etc;
- “processes”: formalisation of new processes, revision of processes with shortcomings, etc.

These recommendations are prioritised as follows:

- 1 - High priority: action to be addressed in the 1st coming year;
- 2 - Medium priority: action to be addressed in the 3 coming years;
- 3 - Low priority: action to be addressed in the 5 coming years.

Category	Recommendations	Priority
Organisation	Set up a proper Customer management department, to provide BWE with an integrated commercial strategy	1
	Set up a special team responsible for updating the customer database: provide a simple reliable tool (project CRP1), train the field teams (fraud control, specific team if necessary) and formalise the task of updating the database	1
	Audit of the facilities in the various offices to ensure that the IT installations are working properly (regular electricity supply, sufficient hardware)	1
Skills	Train the teams who interact with customers to do several tasks: the call centre must be able to provide the customer with subscription information, and the offices must be able to handle customer complaints	1

Tools	Publish the website, and develop it, if necessary, to include access to the invoice and online payment	3
	Integrate the customer information (from the ERP) in the GIS	2
	Following results of the audit of the facilities, provide the offices with the equipment needed to guarantee the same level of service everywhere	1
Processes	Update of the customer database	1
	Implement standardised excel report to monitor key figures (new customers, % of collection, etc.) of the customer management business processes	1
	Create SOP to streamline Customer management business process	2

Table 10: List of recommendations for customer management business process

2.5. FINANCIAL & ACCOUNTING BUSINESS PROCESS

2.5.1. MANDATE

BWE Financial & Accounting has the following main scope of activity:

- General accounting;
- Budget;
- Payment / mandates (suppliers);
- Internal and legal reporting.

In collaboration with the Human Resources & Customers and department and their "Customers" section, the Finance department is responsible for the entire geographical perimeter:

- Supervision of the collection;
- Cash control;
- Billing.

In collaboration with the Distribution & Maintenance Department and its section "Store", the Finance Department is responsible for the financial control of stocks.

In collaboration with the Human Resources department (under the Human Resources & Customers department), the Finance department is responsible for:

- Editing payslips;
- Payroll.

2.5.2. ORGANISATION

This department reports to the General Director, as shown below:

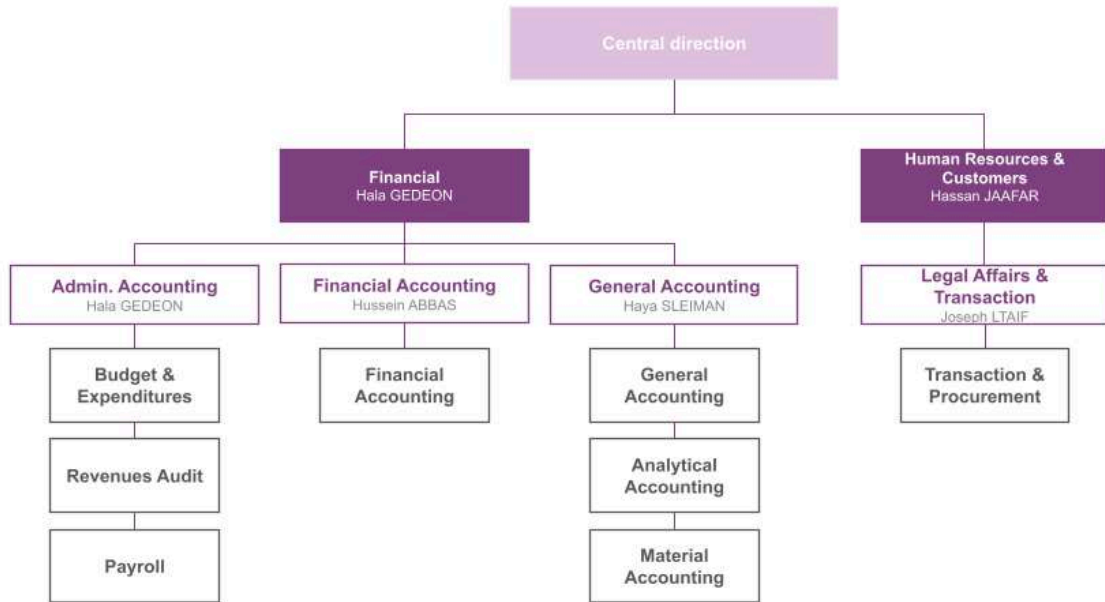




Figure 35: Organisational chart of the departments involved in Financial and Accounting operations


2.5.3. ASSESSMENT OF SUB-PROCESSES DIGITALISATION STATUS

Based on the interviews and on the on-the-job observations, an assessment of the digital tools used in each sub-processes was carried-out, as presented in the tables below, in order to identified the status of digitalisation of each one and the main shortcomings in the current situation:

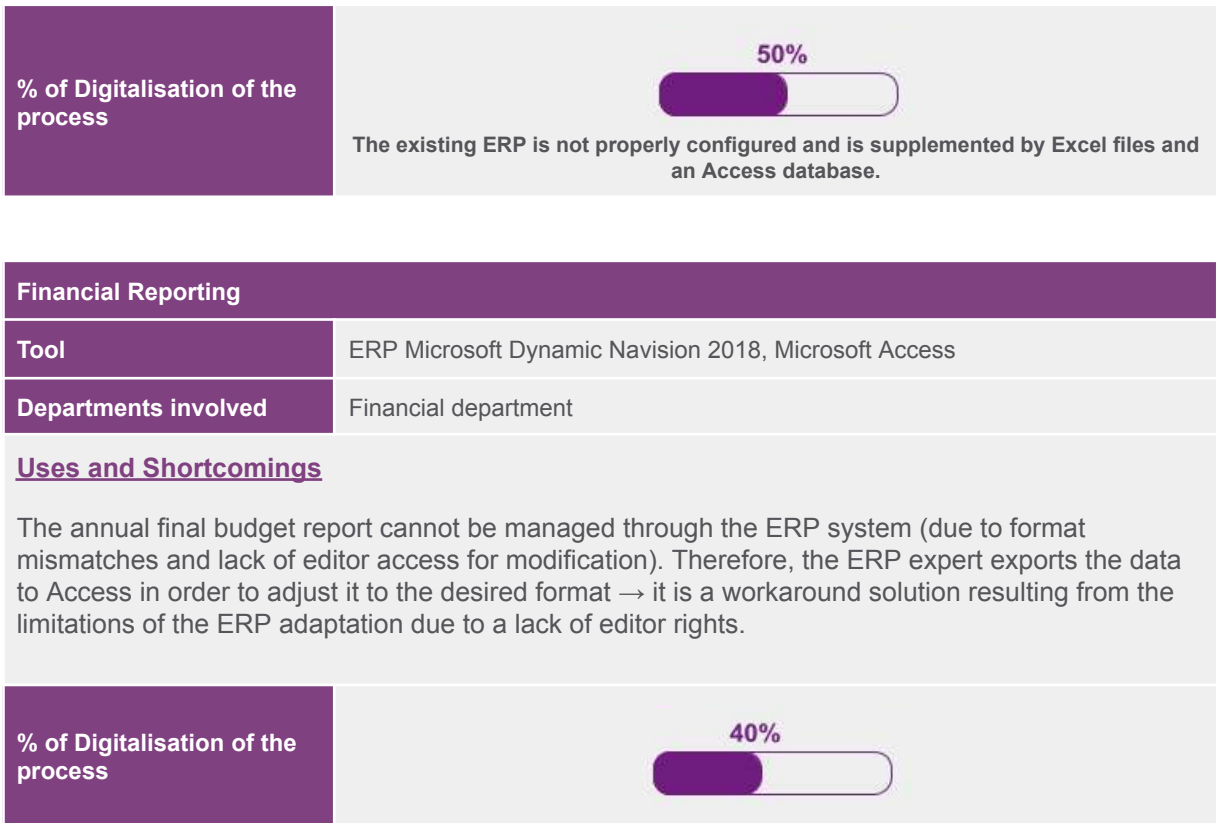
Elaborate budget and control budget execution	
Tool	ERP Microsoft Dynamic Navision 2018, Microsoft Access
Departments involved	Budget & Expenditures (Financial department)
Uses and Shortcomings	
<p>The budget is formulated by using the previous year's budget as a baseline and incorporating a 10-20% increase. However, this approach is not effective as it does not consider the specific requirements of the business.</p> <p>By using this approach, businesses may either end up with insufficient funds, hindering their ability to meet new objectives and challenges, or with excessive funds. A more comprehensive and strategic approach to budgeting is necessary to align financial resources with the current business needs and objectives.</p>	
% of Digitalisation of the process	60%

Manage accounting	
Tool	ERP Microsoft Dynamic Navision 2018
Departments involved	Financial department
Uses and Shortcomings	
<ul style="list-style-type: none"> Accounting and Financial reporting is made in the ERP. When expenditures are entered and validated into the system, the ERP enables to consolidate them in the chart of accounts. Incomes are also consolidated in ERP on an ongoing basis. 	
% of Digitalisation of the process	<div style="text-align: right;">60%</div> 

Ensure revenue reconciliation & monitoring	
Tool	ERP Microsoft Dynamic Navision 2018
Departments involved	Financial department
Uses and Shortcomings	
<p>Reconciliation: All administrative services of each branches send regularly (two to three times per week) to the Finance department:</p> <ul style="list-style-type: none"> a report on the cash collected; the payments receipts; the proof of deposit into the bank account. <p>The Finance department checks the consistency of the information in the software and the receipts received, and consolidates a daily amount of revenue collected.</p> <p>This data is updated by the cash collection service. However, paper forms remain high to ensure traceability and control: daily feedback form from cash collector, proof of deposit, etc.</p> <p>Regarding the payments done via OMT, BobFinance of Cash United, they are extracted from the bank account to integrate it manually in the ERP.</p> <p>Cash collection control / monitoring: The cash collection rate is monitored by the Finance department. The use of ERP to control and reconcile amounts collected is well advanced.</p>	
% of Digitalisation of the process	<div style="text-align: right;">60%</div> 

Manage assets financial recognition	
Tool	ERP Microsoft Dynamic Navision 2018
Departments involved	Financial department
<u>Uses and Shortcomings</u>	
<p>The finance department is responsible for monitoring the financial recognition of assets. However, estimating these values is complex due to the ownership of certain lands being split between BWE and the government. Additionally, not all asset additions (such as network infrastructure) are accounted for, as there is no connection with the GIS or the Warehouse.</p> <p>Only the amounts of new projects shared with Finance are integrated, but without details, making any depreciation calculations impossible.</p> <p>Prior to the Covid crisis, there was a link between the Warehouse and the Budget module of the ERP, and the Warehouse data were accurate due to regular physical inventories. However, since 2020, this link and accuracy no longer exist.</p>	
% of Digitalisation of the process	<div style="text-align: center;"> <p>50%</p>  <p>Tool exist but process is not maintained</p> </div>

Human Resources: Payroll	
Tool	ERP Microsoft Dynamic Navision 2018, Handpunch (Time Management), Microsoft Excel, Microsoft Access
Departments involved	Payroll (Financial department) Human Resources (Human Resources & Customers department)
<u>Uses and Shortcomings</u>	
<p>Payroll unit depends on data from the Human Resources & Customers department to generate the payrolls.</p> <p>Due to the lack of certain data in the ERP system necessary for salary calculations, since November 2021, the payrolls are prepared using an Excel file that compile data from the ERP as well as information from other sources (such as monthly attendance reports, VAT update, sanction) →it is a workaround solution resulting from the limitations of the ERP in capturing all the required data for salary calculations. While this approach allows for the inclusion of additional information from other sources, it introduces complexities and potential errors into the payroll process.</p> <p>Salaries are deposited into the central bank, which is responsible for transferring the funds to private banks, as the BWE cannot directly transfer money to an employee's private bank account.</p> <p>No payslip is provided to the employees.</p>	



2.5.4. SUMMARY

The digitization assessment of sub-processes can be summarised as shown below . It is important to note that this representation does not define digital maturity, but it contributes to the overall understanding of the role of digitalization in the business.



Figure 36: Digitalisation overview of Finance and Accounting subprocesses

2.5.5. SWOT

Based on the initial mission diagnostic, the SWOT matrix below displays the key elements of the diagnostic performed at a department/unit level:

Strengths	Weaknesses
<ul style="list-style-type: none"> The ERP has all basic functionalities for correct accounting; The ERP is used by the employees. 	<ul style="list-style-type: none"> Customer database update insufficient to ensure the complete reliability of finance management; Bank statements not available in ERP; The fixed assets database is out of date; ERP limitations (in its configuration) imposing staff to find workaround
Opportunities	Threats
<ul style="list-style-type: none"> ERP can be customised to meet users' needs. 	<ul style="list-style-type: none"> Employees have become accustomed to using other tools to compensate for ERP gaps.

2.5.6. MAIN RECOMMENDATIONS

The diagnosis of the level of digitalisation of the process has led to a number of recommendations, categorised as:

- “organisation”: reorganisation of teams, cross-team communication, clarification of task allocation, recruitment, etc;
- “skills”: training to be provided;
- “tools”: need for new software or hardware, licences, software improvements, etc;
- “processes”: formalisation of new processes, revision of processes with shortcomings, etc.

These recommendations are prioritised as follows:

- 1 - High priority: action to be addressed in the 1st coming year;
- 2 - Medium priority: action to be addressed in the 3 coming years;
- 3 - Low priority: action to be addressed in the 5 coming years.

Category	Recommendations	Priority
Organisation	N/A	N/A
Skills	Conduct an ERP functional training for all office staff to ensure a better use of the module	1

	Train all ERP users to adopt digital validation through the ERP	2
Tools	Carry out a detailed audit of the ERP system and its limitations in order to upgrade it	2
	Implement the digital validation workflows in the ERP	2
	Give editor rights on the ERP to trained staff	1
Processes	Streamline validation processes so that they become paperless	2

Table 11: List of recommendations for Financial & Accounting business process

2.6. ADMINISTRATIVE, LEGAL, HR BUSINESS PROCESS

2.6.1. MANDATE

BWE presents 3 departments involved in this business process, the Human Resources & Customers department, the Bureau, the Control department.

Their main scopes of activity are:

- HR activities (working hours tracking, leave time tracking, absences monitoring - justified and unjustified);
- Legal activities - not examined during the mission;
- Procurement;
- Control;
- Document management.

Focus on control department:

The Control department reports directly to the Director in a separate department.

Financial control is carried monthly. This control mission includes a technical aspect such as the control of stocks of parts and fuel.

2.6.2. ORGANISATION

These departments report to the General Director, as shown below:

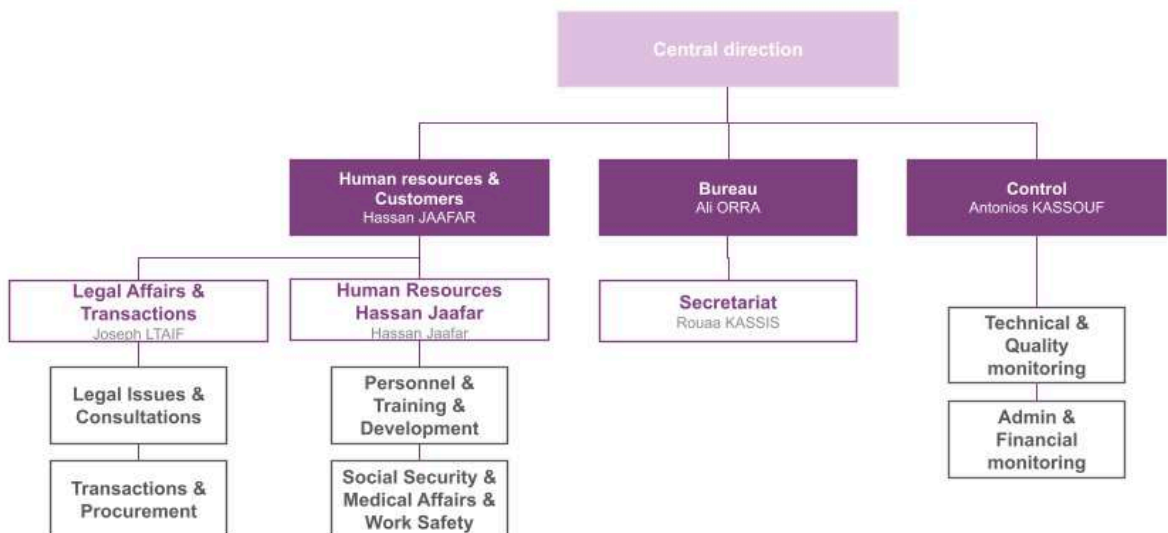


Figure 37: Organisational chart of the departments involved in Administrative, legal, HR business process

2.6.3. ASSESSMENT OF SUB-PROCESSES DIGITALISATION STATUS

Based on the interviews and on the on-the-job observations, an assessment of the digital tools used in each sub-processes was carried-out, as presented in the tables below, in order to identified the status of digitalisation of each one and the main shortcomings in the current situation:

HR Management	
Tool	Handpunch (Time Management), ERP Microsoft Dynamic Navision 2018, Microsoft Excel, Whatsapp
Departments involved	Human Resources section (Human Resources & Customers department)

Uses and Shortcomings

The HR team is responsible for:

- New employee management → paper and ERP;
- Employee termination management → paper and ERP;
- Employee information → WhatsApp groups with all employees to communicate important information:
 - One Whatsapp group where everyone can communicate;
 - One Whatsapp group to communicate Direction's messages.
- Timesheet management → Handpunch machine and monthly report;
- Vacation management → paper;
- Penalty management → paper;
- Connection to the CNSS (Caisse Nationale de Sécurité Sociale - National Social Security Fund) → paper.

Attendance monitoring:

The attendance of employees is reported by the HR department to the Payroll department and followed up thanks to a handpunch system for permanent employees.

As the ERP does not communicate with the handpunch system software, a report from the handpunch machine is received every month, and a reconciliation needs to be done manually by the HR department with the justified absences registered in the ERP → This triggers a waste of time and risk of error.



For temporary employees, an Excel file is manually created every month and sent to the contractor.

The handpunch machine is supplemented by a daily attendance sheet that employees need to sign. The paper flow remains in place in order to control and ensure the traceability of actions carried out in each department (the paper culture remains high, even though ERP processes are secured).

Figure 38: Handpunch machine

Several issues have been identified in the ERP system that prevent the completion of all processes within the ERP and require the use of other parallel supports. This includes the management of leave, which does not function properly in the ERP, as well as certain specific rules, such as bonuses related to children → to address these challenges, it is important to conduct a thorough analysis of the ERP system's capabilities and limitations to correct and improve the ERP.

Health care management:

- The process of reporting a health expenses reimbursement is totally paper-based. The employees use care sheets that they bring to the Health care division. The division employees have to go to the hospital to check the expenses.
- The expenses are only entered manually in the ERP once validated, which enables consolidating them in the accounts.

Other processes:

- There are 2 different type of recruitment:
 - Permanent recruitment: stopped several years ago;
 - Provisional recruitment: contracts renewed annually with private contractors who supply employees. The different departments notify the HR department of their needs for the coming year, HR consolidates the needs and prepares a call for tenders with the procurement department.
- There is no individual performance monitoring process.
- There is no training management process.



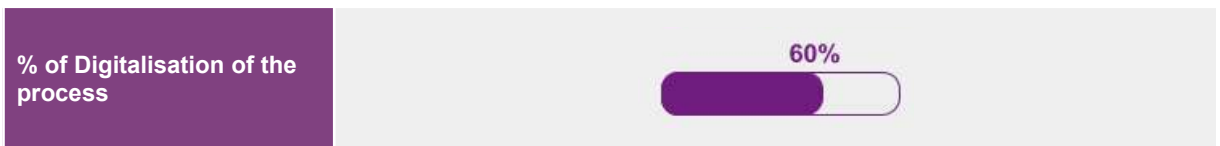
Procurement / Purchase	
Tool	ERP Microsoft Dynamic Navision 2018, Microsoft Excel
Departments involved	Transaction & Procurement unit (Human Resources & Customers department)

Uses and Shortcomings

A purchase request must be submitted in paper format and validated by the Director or regional manager. Once the validated request is received by the procurement department, a call for tender is created, published on the official platform (<https://www.ppa.gov.lb/>), and at least 2 bids must be reviewed. To centralise the exchange, a general email for the Purchase department has been established. All offers received must be digitised in the ERP. The selected offer is sent to the finance department via the ERP system and in paper format.

There is:

- No program / Long term overview of purchases;
- No database of (long-term) contract management (contract start date, contract end date, etc.);
- No SOP or equivalent written guidelines.



Control

Tool	-
Departments involved	Control department

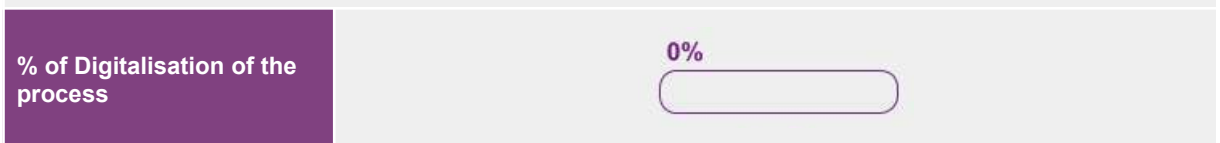
Uses and Shortcomings

The control is directly linked to the General Director. There are two types of control:

- Technical control: interventions control, water quality results control, etc;
- Administrative and financial control: budget control, account control, warehouse control, etc.

However, since the controllers do not have access to the ERP system, they have no visibility on ongoing or past interventions, or the state of finances. Additionally, each action requires a letter from the CEO authorising an audit of a department, which takes time.

In theory, the controller can propose sanctions in case of errors, which are then transferred to the HR department.



Document Management System

Tool	ERP Microsoft Dynamic Navision 2018
Departments involved	All departments Secretariat

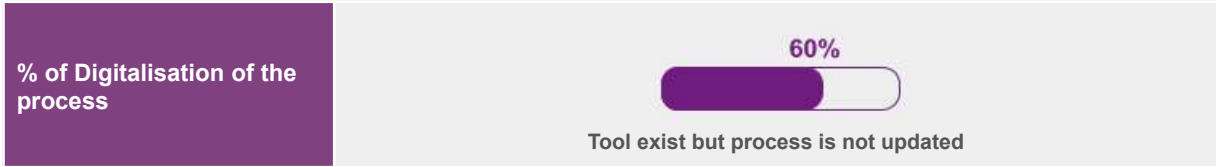
Uses and Shortcomings

The document management process is cumbersome, requiring every exchange to go through the Secretariat for registration in the ERP system as well as on a paper register. This applies to letters/documents that need to be transferred between internal departments or communicated externally. Before 2020, approximately 50 letters had to be processed and signed by the General Director every day before being transferred to the intended recipient.

This heavy process significantly impacts the speed of communication between different departments, having a direct and significant impact on operations (such as intervention requests), as well as the quality of the document control.

All departments have access to the DMS module in the ERP.

Note that to date, no analysis has been conducted on the module to establish the average processing time for example.



2.6.4. SUMMARY

The digitization assessment of sub-processes can be summarised as shown below . It is important to note that this representation does not define digital maturity, but it contributes to the overall understanding of the role of digitalization in the business.

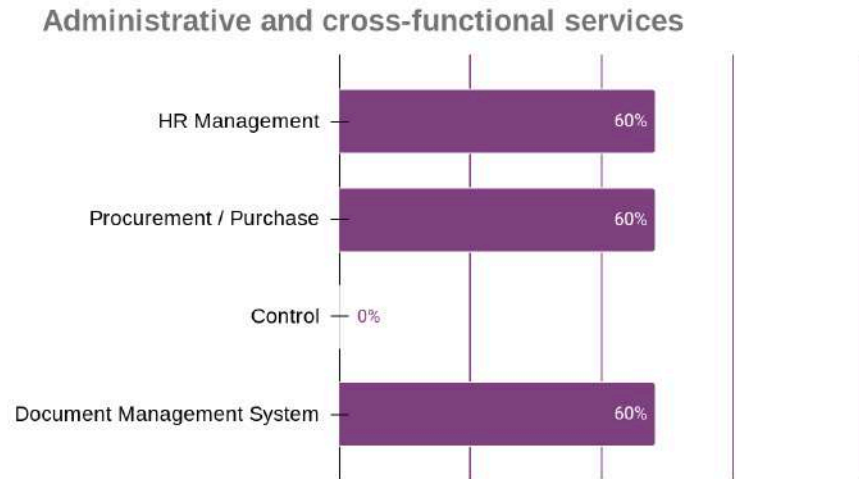


Figure 39: Digitalisation overview of Administrative and cross-functional subprocesses

2.6.5. SWOT

Based on the initial mission diagnostic, the SWOT matrix below displays the key elements of the diagnostic performed at a department/unit level:

Strengths	Weaknesses
<ul style="list-style-type: none"> ERP has all basic functionalities to manage correctly HR, purchase, and other administrative processes; ERP includes archiving of important papers (purchase order, work acceptance...); The current version of the ERP includes 	<ul style="list-style-type: none"> No existing SOPs; The validation workflows and the communication between departments are still made on paper; No sharepoint / shared drive; The monitoring of overtime and leaves is still made on paper/excel, and the

a document control module .	procedures to do it is unclear; <ul style="list-style-type: none"> • The time attendance monitoring software is underused; • Control department does not have access to the ERP.
Opportunities	Threats
<ul style="list-style-type: none"> • Integration of the Timesheet report in the ERP. 	

2.6.6. MAIN RECOMMENDATIONS

The diagnosis of the level of digitalisation of the process has led to a number of recommendations, categorised as:

- “organisation”: reorganisation of teams, cross-team communication, clarification of task allocation, recruitment, etc;
- “skills”: training to be provided;
- “tools”: need for new software or hardware, licences, software improvements, etc;
- “processes”: formalisation of new processes, revision of processes with shortcomings, etc.

These recommendations are prioritised as follows:

- 1 - High priority: action to be addressed in the 1st coming year;
- 2 - Medium priority: action to be addressed in the 3 coming years;
- 3 - Low priority: action to be addressed in the 5 coming years.

Category	Recommendations	Priority
Organisation	N/A	N/A
Skills	N/A	N/A
Tools	Identify the digitalised steps that no longer require paper duplication (example: attendance monitoring, request of order in purchase process)	1
	Finalise handpunch connection to the ERP to consolidate the time management data	2
	Identify the reporting needs that could be covered by an automatic ERP report (dashboard)	2
	Develop the ERP contract management module (framework purchasing agreements, etc.)	2
	Make accessible the ERP to the Control department staff	1

Processes	Develop HR procedures (recruitments, individual performance monitoring, overtimes and leaves calculations, etc)	1
	Develop procurement procedures (call for tender, bid archiving...)	1

Table 12: List of recommendations for administrative, HR and Procurement business process

2.7. TECHNICAL & STUDIES BUSINESS PROCESS

2.7.1. MANDATE

BWE has one department involved in Technical & studies, even though few projects are implemented.

This section is responsible for the following main tasks:

- Receiving the contractor's work delivery file and monitoring the execution of the transactions in accordance with the specifications;
- Checking that work is being carried out according to the defined schedules;
- Monitoring problems of all kinds arising from the application of contracts and proposing solutions for each of them;
- Preparing the documents needed to finalise the project;
- Determining network and drilling location and recording the information in a dedicated register.

2.7.2. ORGANISATION

This department reports to the General Director, as shown below:

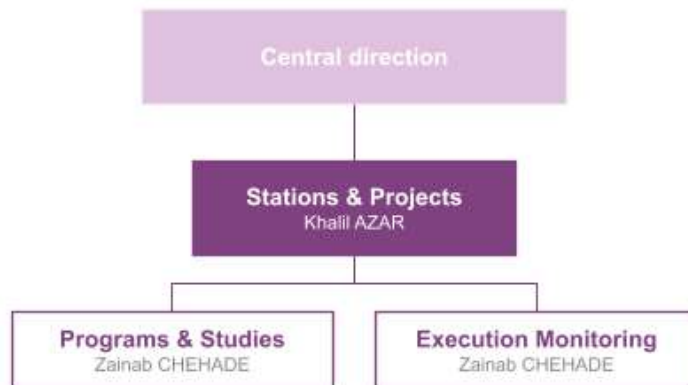


Figure 40: Organisational chart of the departments involved in Technical & studies

2.7.3. ASSESSMENT OF SUB-PROCESSES DIGITALISATION STATUS

Based on the interviews and on the on-the-job observations, an assessment of the digital tools used in each sub-processes was carried-out, as presented in the tables below, in order to identified the status of digitalisation of each one and the main shortcomings in the current situation:

Project Management / Studies management	
Tool	-
Users	-
Uses and Shortcomings	
<ul style="list-style-type: none"> • There is no team in the two sections (Program & Studies + Execution Monitoring) and all 	

- work falls on the head of the sections.
- There is no software accessible due to the cost and the lack of training. Examples: SCADA, ERP, GIS and Autocad or other software for monitoring and designing water networks.
- In this context, it is impossible for BWE to carry out studies.



2.7.4. SWOT

Based on the initial mission diagnostic, the SWOT matrix below displays the key elements of the diagnostic performed at a department/unit level:

Strengths	Weaknesses
	<ul style="list-style-type: none"> • No taskforce to lead projects; • No access to required tools (SCADA, ERP, GIS, AutoCAD).
Opportunities	Threats
<ul style="list-style-type: none"> • Existing sections with Head of Section. 	<ul style="list-style-type: none"> • Economic crisis in Lebanon, which limits the budget available for BWE and prevent the project department to pay for the licence fees, get additional staff or keep skilled staff to perform department activities activities; • The lack of projects leads to a decrease in motivation and a lack of challenge for the teams in terms of methods and processes.

2.7.5. MAIN RECOMMENDATIONS

The diagnosis of the level of digitalisation of the process has led to a number of recommendations, categorised as:

- “organisation”: reorganisation of teams, cross-team communication, clarification of task allocation, recruitment, etc;
- “skills”: training to be provided;
- “tools”: need for new software or hardware, licences, software improvements, etc;
- “processes”: formalisation of new processes, revision of processes with shortcomings, etc.

These recommendations are prioritised as follows:

- 1 - High priority: action to be addressed in the 1st coming year;
- 2 - Medium priority: action to be addressed in the 3 coming years;
- 3 - Low priority: action to be addressed in the 5 coming years.

Category	Recommendations	Priority
Organisation	Dedicate O&M staff or hire staff to carry out or supervise installations & networks improvement and extension projects	1
Skills	Train BWE staff to perform design and review tasks for in house or subcontracted projects	1
Tools	Make accessible the existing BWE tool to the stations and projects department (SCADA/GIS), Get necessary design tools to carry out projects (autoCAD, waterCAD, etc..)	1
Processes	N/A	N/A

Table 13: List of recommendations for Technical & studies business process

3. OVERALL DIGITAL MATURITY DIAGNOSTIC OF BWE

3.1. BWE'S DIGITALISATION CONTEXT & PAST INITIATIVES

3.2. BWE'S DIGITAL TOOLS OVERVIEW

3.2.1. SOFTWARES CURRENTLY USED IN BWE

The table below details the softwares used by each business process:

Tools managed	Version	Licence	Use	Used by
ERP Microsoft Dynamic Navision 2018	2018	45	To plan company resources, to support finance, manufacturing, customer relationship management (CRM), and human resources management. The ERP system has been adopted by BWE since 2014 and is funded by USAID.	Billing and collection: customer unified database (proposé par Navision) qui est utilisée Document register HR CRM Budget module Warehouse
TeamViewer	Online free update		To enable remote troubleshooting by IT teams	IT All staff with a computer
SQL Server 2017	2017		To store all organisation information on SQL	
GIS	ArcGIS Desktop Standard, Spatial Analyst, Network Analyst, Arcgis GIS ServerStandard, ArcGIS Notebooks Standard	1	To create, manage, analyse, and map all types of data	Technical
Uagent For Call Center		4	To receive telephone calls from subscribers and record information about them, whereupon the	CRM

			complaint is recorded in the ERP system. The Uagent system was adopted by the BWE in 2019 and is funded by Unicef.	
Sophos Antivirus	XG210	1	To protect against critical malware, phishing websites, and ransomware. The sophos antivirus is funded by USAID.	All staff with a computer
Microsoft Office 365	2019	100	To provide access to emails and office tools (Excel, Word, Access)	All staff with a computer
Veeam Backup & Replication 10		1	To save regularly a copy of all programs and data	IT
Hprocom	V6.8.141 s	1	To extract the employee's fingerprint from the HandPunch machine	HR
Time Management	V6.8.141 s	1	To calculate the employee's working time from the records in the Hprocom programme	HR

Table 14: BWE's software list

3.2.2. BWE's SOFTWARES MAPPING

The figure below illustrates how the various software packages fit into the overall IT architecture. It details the departments in which the softwares are used, the data flows between them, and their status of use.

It was drawn up as a basis for comprehension, and to visually identify the possible interactions that might improve the overall integration.

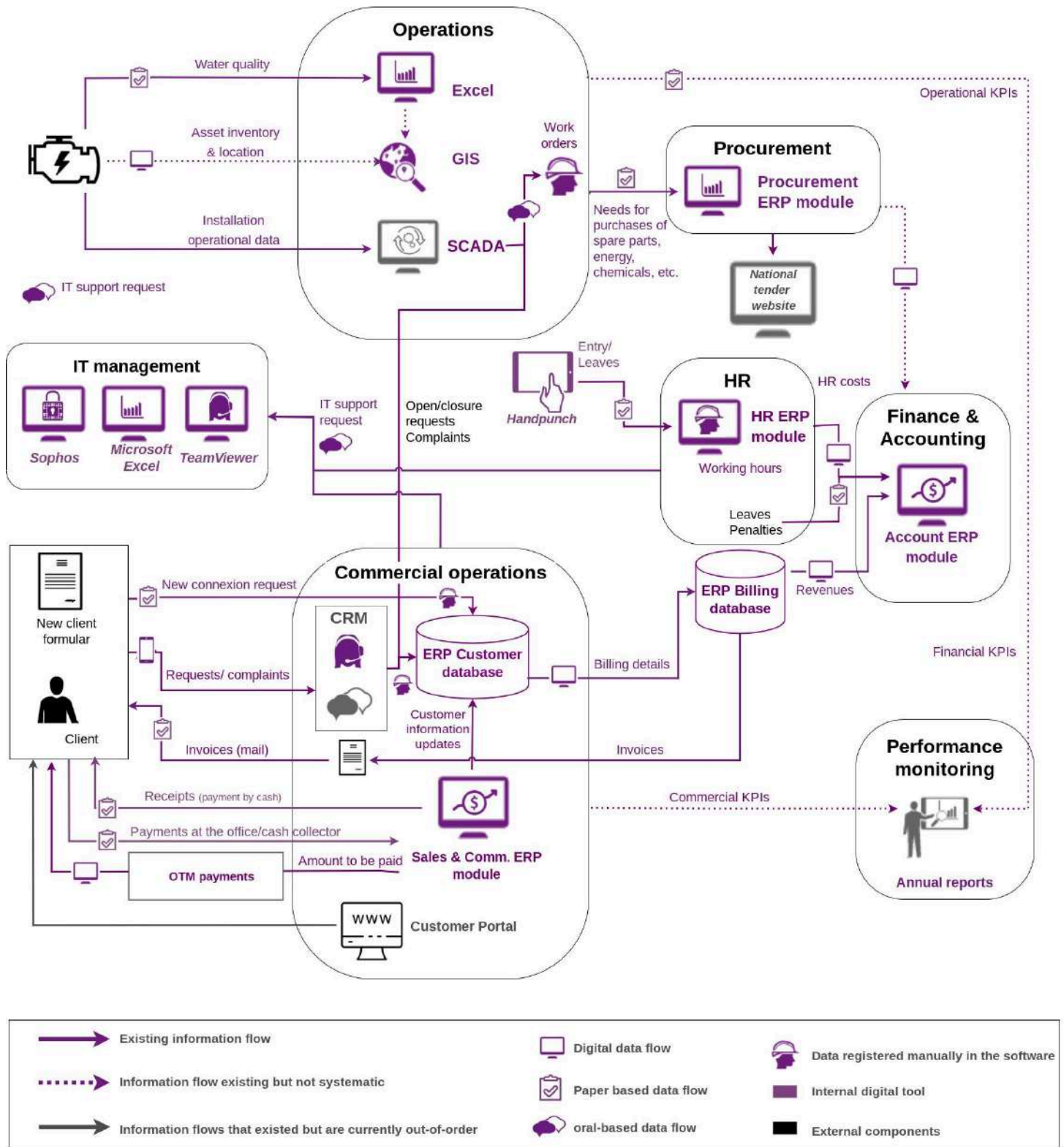


Figure 41: BWE's software mapping

3.3. SWOT

Based on the initial mission diagnostic, the SWOT matrix below displays the key elements of the individual SWOT performed at a department/unit level as well as a global analysis:

Strengths	Weaknesses
<ul style="list-style-type: none"> ● Strong financial contribution of USAID (software, licences, hardware, training...); ● Relevant overall infrastructure; ● Existing SCADA to operate remotely 30% of the installations; ● Traceability culture regarding the water quality management (regular reporting); ● Dedicated modules in the ERP for the customer, finance, procurement and HR; ● The current version of the ERP includes a document control module. 	<ul style="list-style-type: none"> ● Lack of IT master plan; ● No regular reports are requested from management; ● Lack of overall documentation (training, user manual...); ● Undersized hardware for ERP use; ● Few skills in automation available in the Establishment.
Opportunities	Threats
<ul style="list-style-type: none"> ● SCADA being extended step by step to ultimately control all BWE installations; ● Report being created in the SCADA to track production and consumption; ● Technical staff of BWE motivated to improve SCADA topics, even if they do not have automation knowledge; ● Existing GIS, but there is a need to improve the way information (new installation or network) is transmitted; ● Ongoing website development. 	<ul style="list-style-type: none"> ● Centralization of IT service making the user support difficult; ● All licences, maintenance & support fees are in USD and hard to handle due to the economic crisis and LBP inflation (WAN connection, mobile app subscription, web development and hosting, UPS maintenance, photocopier maintenance...); ● Remote access to Main SCADA (cybersecurity threat); ● The lack of projects leads to a decrease in motivation and a lack of challenge for the teams in terms of methods and processes. ● Employees have become accustomed to using other tools to compensate for ERP gaps. ● Willingness to keep paper (for subscription, invoice, etc).

Table 15: BWE overall SWOT

3.4. DIGITAL MATURITY ASSESSMENT

The digital maturity assessment consists in evaluating the current performance of the utility in its various business processes in relation to international best practices using SEURECA's proprietary maturity grid. The different maturity levels are described below:

Level	Scoring	Description
Innocent	0	The utility does not have any activities related to the business function
Aware	1	The utility performs basic activities related to the business function but lacks organisation, tools and processes as well as competences to be efficient
Developing	2	The utility has initiated a number of measures to improve its performance in the activities related to the business function
Competent	3	The utility performs the activities related to the business function sufficiently well to secure the sustainability of the business
Advanced	4	The utility has implemented a series of international best practices and launched a process of continuous improvement in the activities related to the business function
Expert	5	The utility is recognised as an expert in the activities related to the business function and has systematically implemented international best practices

Based on the interviews with the different departments and the on-the-field observations, SEURECA assessed the current maturity of BWE. Based on SEURECA's perceptions, experience of the Water Utilities worldwide and discussions with General Management, it is compared to the **targeted maturity state at mid- and long-term** in order to identify the actions required to reach those target states.

The result of the Digital Maturity assessment is summarised below.

	Current maturity rating	Target maturity state Horizon 5 years
Governance / Strategy / Organisation	<p>Level 1 - "Aware"</p> <p><i>Management is convinced of the impact of digital transformation on the quality of service and performance of the Establishment. However, it has not provided sufficient organisational, human and material resources, nor the necessary budget to start this transformation plan in the best conditions.</i></p>	<p>Level 3 - "Competent"</p> <p><i>Management is convinced of the impact of digital transformation on the quality of service and performance of the Establishment. It is adapting the organisation and recruiting the right people. It has a clear vision of the holistic implementation of the digital transformation project and a coherent roadmap and action plan.</i></p>
Technology: Infrastructure / Architecture / Data / Security	<p>Level 1 - "Aware"</p> <p><i>The IT development plan follows the recommendations of the master plan, the IT infrastructure is well dimensioned and the outsourcing system in place satisfies users (no interruptions).</i></p> <p>→ Note that BWE does not have an IT master plan or a regular security audit, but given the other assessed criteria, level 1 seems the most</p>	<p>Level 4 - "Advanced"</p> <p><i>Security architecture and policies are documented and fully implemented. Databases are managed, including security and performance.</i></p> <p><i>Documented Business Continuity Plan for critical applications. Managed services interventions are tracked through an intervention management platform. Some preventive maintenance tasks are</i></p>

	Current maturity rating	Target maturity state Horizon 5 years
	appropriate.	performed, such as firewall updates, software or operating system version management.
Customer Relation / ERP / Services digitalisation	<p>Level 2 - "Development"</p> <p>The Customer relationship management is integrated with a maintenance contract and version updates. Each customer manager in the sales office is multi-skilled and can handle any type of transaction (multi-skilled). The complaints system is centralised but not connected to the ERP, complaints are traced regardless of the channel used.</p>	<p>Level 4 - "Advanced"</p> <p>The Customer relationship management is integrated with a maintenance contract and version updates. Each customer service representative in the sales office is multi-skilled and can handle any type of operation (multi-skilled) and can record complaints with an application integrated and centralised in the CRM. Complaints are traced regardless of the channel used and connected to the intervention management system. Possibility to measure intervention times. The customer can also carry out any type of operation from an online agency or mobile application. The process of handling requests is dematerialised within the Establishment. The Establishment is active on social media and communicates any operation event.</p>
Public service / Asset life cycle	<p>Level 0 - "Innocent"</p> <p>No asset database of the Establishment's assets is updated on a permanent basis. Assets monitored by acquisition contract.</p>	<p>Level 3 - "Competent"</p> <p>The equipment and network asset databases (GIS) are permanently updated on a platform linked to "fixed assets" accounting and coupled with a CMMS with exhaustive monitoring of corrective and preventive maintenance operations</p>
Operation Management	<p>Level 2 - "Development"</p> <p>Existence of an incomplete telemetry system with alarm and measurement monitoring, remote control operations.</p>	<p>Level 3 - "Competent"</p> <p>Existence of a complete telemetry system with alarm and measurement monitoring, remote control operations</p>
Works Management and Follow Up	<p>Level 0 - "Innocent"</p> <p>Insufficiently documented monitoring of works.</p>	<p>Level 2 - "Development"</p> <p>Existence of an internal works monitoring tool with exhaustive traceability of works with start dates, monitoring of attachments, disbursements, recording of reports and test reports, photo reports.</p>
Supplier Relation	<p>Level 2 - "Development"</p> <p>All transactions with suppliers are carried out by mail, fax and paper documents.</p> <p>Posting of Tenders on the website.</p> <p>No internal application for contract management.</p>	<p>Level 3 - "Competent"</p> <p>All transactions with suppliers are carried out by mail, fax and paper documents.</p> <p>Posting on the website via the supplier platform of the Tenders, downloading of the Tenders and communication of the judgement stages.</p>

	Current maturity rating	Target maturity state Horizon 5 years
	<i>Financial terms of the contract entered manually in the ERP.</i>	<i>Internal tender and contract management application.</i>
Supports services digitalisation / Accounting	<p>Level 1 - "Aware"</p> <p><i>Integrated accounting and financial ERP with purchasing, fixed assets, general accounting, cost accounting, budgeting, works, treasury and payroll functions.</i></p>	<p>Level 3 - "Competent"</p> <p><i>Integrated accounting and financial ERP with the functions of purchasing, fixed assets, general accounting, cost accounting, budgeting, works, treasury and payroll, with gateways to all commercial information systems, bank sites, the tax department, the asset database and the purchase requests of the various departments.</i></p> <p>→ No more paper validation workflow.</p>
Staff / HR digitalisation	<p>Level 1 - "Aware"</p> <p><i>The use of digital means (Whatsapp) makes it possible to increase exchanges with employees.</i></p> <p><i>Working time management thanks to the time attendance system, but not integrated to the ERP payroll module.</i></p> <p><i>Absences, holidays monitored on a separate Excel and manually entered into the payroll software for the production of pay slips.</i></p> <p><i>No dematerialised procedures for other HR processes (recruitment, work accidents monitoring, etc)</i></p>	<p>Level 3 - "Competent"</p> <p><i>The dematerialisation of internal procedures enables exchanges via a digital workflow.</i></p> <p><i>Working time management: Time sheet / working time monitoring integrated to the ERP to facilitate the feedback of data from payroll, absences, holidays, work accidents, with intermediate declaration and validation.</i></p> <p><i>HR ERP platform with direct access by employees to monitor their personal file and update their personal data (personal data, career path, evaluation, pay slip, certificate management, leave management, training plan monitoring), display of procedures and safety instructions.</i></p>

Table 16: Digital Maturity assessment

In order to have a more synthetic view of the digital maturity results in its 9 dimensions, a radar chart is used (see Figure 42: Consolidated maturity radar). It clearly displays the gap between the current maturity and the targeted one which will be used to estimate the investments required to achieve the transformation objectives.

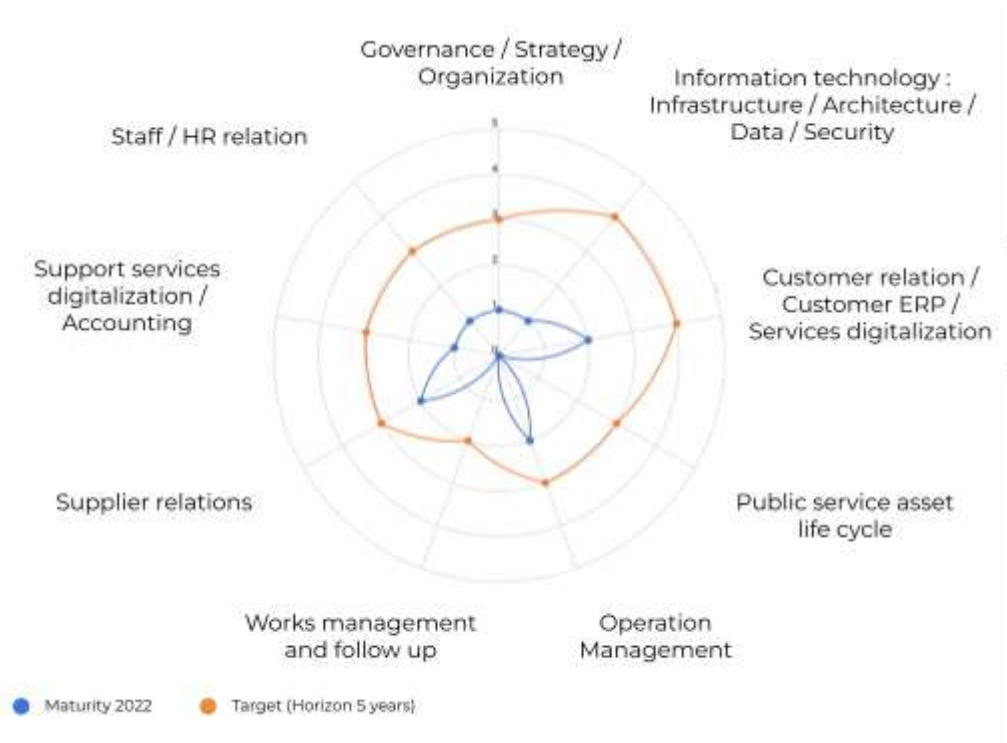


Figure 42: Consolidated maturity radar

4. ACTION PLAN & DIGITAL TRANSFORMATION ROADMAP

Based on the SWOT analyses and the gap analysis carried out for each of the processes, the following chapter proposes a consolidated vision of the action plan.

4.1. THE ESTABLISHMENT IN THE NEXT 5 YEARS - OBJECTIVES

The target state defined after the establishment's maturity diagnosis can be broken down into different specific objectives to be achieved by the utility. These correspond to the criteria to be met in order to achieve the target level of digital maturity. These are listed below :

Digital maturity axis	Targeted maturity level	Maturity Level definition (target objectives)	Objectives #
Governance / Strategy / Organisation	Level 3 - "Competent"	There is a coherent digitalisation roadmap, approved by the top-management	GOV1
		The staff is aware of digital transformation and involved in the implementation.	GOV2
		There is an identified team in charge of digital transformation lead, management and progress monitoring.	GOV3
		Digital information flow enables to calculate Key Performance indicators on a regular basis.	GOV4
Technology : Infrastructure / Architecture / Data / Security	Level 4 - "Advanced"	An IT Service Management is deployed (interventions management platform, skilled team)	IT1
		IT architecture is secured and related policies are fully implemented.	IT2
		Digital tools and databases are regularly maintained, well dimensioned, and have the functionalities required for optimal utilisation and data security.	IT3
		There is a documented ITC Business Continuity Plan for critical applications.	IT4
Customer Relation / ERP / Services digitalisation	Level 4 - "Advanced"	The customer's information is digitalised and up-to-date.	CR1
		All customer management information are consolidated in the same database (customer information, invoices, payments, complaints, customer service portal information, etc)	CR2
		Customer journey is streamlined and digitalised (CRM and Customer Service Portal are fully implemented)	CR3
		Communication processes (on social media, on establishment website, etc) are fully implemented	CR4
Public service / Asset life cycle	Level 3 - "Competent"	The Network's condition is up-to-date and monitored in a GIS.	PS1
		Equipment condition is monitored in the CMMS.	PS2
		GIS and CMMS are integrated into the ERP (fixed assets financial database).	PS3

Digital maturity axis	Targeted maturity level	Maturity Level definition (target objectives)	Objectives #
Operation Management	Level 3 - "Competent"	Implement a SCADA organisation	OP1
		A complete instrumentation system is deployed in all operations sites, with alarm and measurement monitoring.	OP2
		A complete instrumentation system is deployed in all operations sites, with remote control operations.	OP3
Works Management and Follow Up	Level 2 - "Development"	Equipment database in CMMS is fully implemented and ensures traceability of interventions.	WM1
		CMMS is integrated to ERP (stock management)	WM3
		CMMS is able to issue work orders considering preventive maintenance and intervention requests.	WM4
Supplier Relation	Level 3 - "Competent"	All transactions with suppliers are done by email or paper document (if required).	SR1
		Internal tenders & contracts management module is implemented.	SR2
		The process of purchase of products and services (under tender procedures threshold) is fully managed on the ERP.	SR3
Supports services digitalisation / Accounting	Level 3 - "Competent"	The ERP is implemented in the branches and in the relevant departments.	SA1
		The ERP is permanently linked to all commercial, bank, taxes, assets information systems.	SA2
		No more paper validation workflow.	SA3
Staff / HR digitalisation	Level 3 - "Competent"	Working time monitoring is automatically integrated to the ERP.	HR1
		The dematerialisation of internal procedures enables exchanges via a digital workflow (pay slip, training, etc)	HR2

Table 17: Details of the 5-years objectives

A **gap analysis** was then conducted to identify the different actions required to reach the objectives listed above.

The different actions are organised regarding 3 categories:

- **"Strategic framework"**: these actions are the ones required to support the overall Digital transformation of the establishment. They are mostly focused on:
 - the strengthening of the institutional framework and the water establishment organisation;
 - the setting and implementation of a structured, competent ICT department, and the tools required for its performance;

- the reinforcement of the overall ICT infrastructure and equipment, laying the foundations for a secure data management and business continuity policy;
 - the creation of a digital culture among the staff.
-
- **“General IT/OT improvement”**: these actions correspond to improvements in business software and SCADA, which contribute to the water establishment's overall performance by supporting several business processes (customer management, finance, O&M, etc.). Those tasks are often necessary to then implement improvements focused on specific issues/shortcomings of each business process. For instance, those actions deal with:
 - general ERP improvements which enable to reduce paper use for communication between departments or validation;
 - KPIs and reporting procedures implementation;
 - SCADA improvement and implementation for better water production and energy consumption monitoring.

 - **“Specific process improvements”**: these actions focus on the problems of a specific business process. They are aiming at improving service quality and continuity as well as operational performance by digitalising and optimising existing tools; they often require the implementation of actions from the previous two categories. Their implementation generally leads to concrete performance gains, or even quick wins (customer database update, NRW management, revenue collection improvement, etc.). This category is therefore presented by sub-business processes (energy management, revenue collection management, accounting, etc).

For the sake of consistency and ease of comparison, the same categories and subcategories have been applied to all three water establishments. In addition, for the reasons given above, SEURECA has chosen to keep, as far as possible, the same sub-categories (in pink) as SLWE's action plan.

These actions have been **grouped, prioritised and budgeted** and are presented in the next section.

4.2. DIGITAL TRANSFORMATION ACTION PLAN

The table below presents the **5-years action plan for BWE's digital transformation**.

The prioritisation of actions and their phasing over time have been designed as follows:

- **Actions that are necessary for BMLWE to reach a "competent" level of digital maturity** - i.e. to ensure a level of service that meets international standards - and those enabling rapid gains are considered to be carried out in the next few years **(2025-2029)**.
- **Complementary actions, which should enable performance gains but represent a major investment that is best spread out over time, or are less essential to the efficient day-to-day operation** of the water service, are considered to be carried out as a continuation of the previous actions, during the following years **(2030 - 2034)**.



Please note that the amounts presented in the table below are rough budget estimates. It will need to be reviewed and precised at the procurement stage.



CAPEX & OPEX

CAPEX: SEURECA considered as CAPEX the costs not recurring over the long term and not included in the WE's ordinary operations: project management, training, audit / complementary diagnosis, technical assistance, hardware and software implementation.

OPEX: SEURECA considered as OPEX the costs recurring over the long-term (including after 2027) and part of the necessary expenses for daily operations of the WE: licence renewal, maintenance, etc.

Please note that costs related to HR costs of internal staff are not addressed in the estimates, as they are not considered as additional regarding the current situation.

Action code	Action description	Related Maturity Grid Objective	Prerequisites	2	2	2	2	2	2	2	2	2	2	Priority	Complexity	CAPEx	OPEx	Description
				0	0	0	0	0	0	0	0	0	0					
				5	6	7	8	9	0	1	2	3	4					
STRATEGIC FRAMEWORK																\$1,152,600	\$240,800	
SF-1	Strategy and general organisation															\$51,000	\$0	
SF-1.1	Streamline the organisation between the branches and the headquarter to facilitate the strategy implementation	GOV1	SF-1.2	x	x									High	Medium	\$45,000	-	Consultancy (diagnostic + recommendations) including on-site mission
SF-1.2	Complete an operational and digital assessment of the future sanitation department recently integrated into the WE		-	x										High	Medium	-	-	Included in SF 1.1
SF-1.3	Encourage NGOs to cover OPEX in their project proposals, or refuse projects that do not have the necessary OPEX funding		-	x										High	Low	-	-	Internal staff
SF-1.4	Set up a Customer management directorate or department, to provide the establishment with an integrated commercial strategy	GOV3	SF-1.1	x	x									Medium	Medium	-	-	Included in SF1.1
SF-1.5	Establish a "project mode" for IT projects by designating roles (empowerment of a project manager and contributors) and a schedule	GOV1 GOV3	SF-1.1	x										High	Low	\$6,000	-	Training
SF-2	ICT department reinforcement															\$82,900	\$1,600	
SF-2.1	Define CIO job description Identify the required resource within the water establishment staff	GOV3	SF-1.1	x										High	Low	-	-	Replication of SLWE Job Descriptions
SF-2.2	Define PMO job description Identify the required resource within the water establishment staff	GOV3	SF-1.1	x										High	Low	-	-	Replication of SLWE Job Descriptions

Action code	Action description	Related Maturity Grid Objective	Prerequisites	2	2	2	2	2	2	2	2	2	2	Priority	Complexity	CAPEX	OPEX	Description
				0	0	0	0	0	0	0	0	0	0					
				5	6	7	8	9	0	1	2	3	4					
SF-2.3	Define a security officer job description Identify the required resource within the water establishment staff	GOV3 IT2	SF-1.1	x										High	Low	-	-	Replication of SLWE Job Descriptions
SF-2.4	Reinforce cyber security culture through training and regular refresh session	IT2	SF-2.3		x									Medium	Low	\$10,000	-	Training + internal awareness campaign
SF-2.5	Create the missing IT policies (eg Security Awareness and Training Policy, Remote Access Policy, Data Protection and Privacy Policy, Password policy...) and plan regular training	IT2	SF-2.1 SF-2.2 SF-2.3	x										Medium	Low	\$20,500	-	Consultancy (diagnostic + recommendations) including on-site mission and training
SF-2.6	Create a Business Continuity Plan (BCP)	IT4	SF-2.1 SF-2.2 SF-2.3 SF-3.1 SF-3.2		x									Medium	Medium	\$50,000	\$1,600	Consultancy including on-site mission + yearly updates
SF-2.8	Initiate interoperability principles while the number of applications is limited to ensure a correct communication with the future digital tools	IT2	SF-2.1 SF-2.2	x	x									Low	Low	\$2,400	-	Consultancy Yearly updates performed by internal staff
SF-3	ICT Infrastructure reinforcement															\$509,100	\$0	
SF-3.1	Audit of the facilities in the various offices to ensure that the IT installations are working properly (regular electricity supply, sufficient hardware...)	IT2 IT3 SA1	SF-1.5 SF-2.1 SF-2.2 SF-2.3	x										High	Medium	\$24,000	-	Consultancy (diag. + recommendations) including on-site mission
SF-3.2	Following the audit result, provide the offices with the equipment needed to guarantee a sufficient and similar level of service everywhere (regular electricity supply, sufficient hardware...)	IT2 IT3 SA1	SF-1.5 SF-3.1	x	x									High	Medium	\$25,000	-	Purchase of equipment & Works

Action code	Action description	Related Maturity Grid Objective	Prerequisites	2	2	2	2	2	2	2	2	2	2	Priority	Compl exity	CAPEx	OPEx	Description
				0	0	0	0	0	0	0	0	0	0					
				5	6	7	8	9	0	1	2	3	4					
SF-3.3	Define Cyber security audit expectation (TOR) and Perform a Cybersecurity audit including risk analysis of applications softwares to identify critical ones	IT2	SF-1.5 SF-2.3	x										Medium	Medium	\$88,500	-	Consultancy for ToR drafting & Cybersecurity audit
SF-3.4	Define and implement changes based on the results of the audits and BCP strategy to secure the infrastructures	IT2 IT3	SF-1.5 SF-2.6 SF-3.3	x	x									Medium	High	\$350,000	-	Estimate based on SLWE
SF-3.6	Create a renewal plan for hardware following the Responsible and Sustainable Digital best practices	IT3	SF-3.1 SPI-13.2	x										Medium	Low	\$1,600	-	Consultancy
SF-3.7	Implement changes to the OT Network, such as the addition of a DMZ, to allow the business tools to have access to SCADA data	GOV4 IT2		x	x									Medium	Medium	\$11,500	-	Purchase of hardware & software (firewall, DMZ, etc.) & implementation
SF-3.8	Update server hardware in order to operate the ERP in good conditions	IT3	SF-3.1 SF-3.2	x										High	Low	\$8,500	-	Purchase & installation of an additional server/CPU
SF-4	SCADA Activities Structuration															\$506,400	\$210,000	
SF-4.1	SCADA strategy : Establish a SCADA operational strategy regarding Processes, Responsibilities, Maintenance, On-call duty, Cybersecurity, etc. In particular, define the breakdown of responsibilities between internal staff and external staff.	OP1	-	x										Low	Medium	\$8,000	-	Consultancy (SCADA audit + recommendations) including on-site mission
SF-4.2	SCADA strategy : Define SCADA standards (specifications, SOP, guidelines,etc) to homogenise hardware, data collection, schematics and interfaces in the establishment	OP1	SF-4.1	x										Low	High	\$4,000	-	Consultancy (SCADA audit + recommendations) including on-site mission
SF-4.5	Define I&C Referent job description	OP1	-	x										Low	Low	-	-	Replication of SLWE Job Descriptions

Action code	Action description	Related Maturity Grid Objective	Prerequisites	2	2	2	2	2	2	2	2	2	2	Priority	Complexity	CAPEx	OPEx	Description
				0	0	0	0	0	0	0	0	0	0					
				5	6	7	8	9	0	1	2	3	4					
SF-4.6	SCADA staff : Identify the required resource within the water establishment staff Hire or train an Instrumentation & Control referent that will supervise the different SCADA implementation stages, with the different contractors. Or contract a TA to ensure the same responsibilities	OP1	SF-4.5		x									Medium	Medium	\$480,000	-	Consultancy (diagnostic + recommendations) including on-site mission Potential recruitment are not included
SF-4.7	SCADA external staff : Verify that Modon can mobilise at least two experts for the SCADA implementation, operation and maintenance and contract 2 SCADA technicians to help on these tasks	OP1	SF-4.6		x	x	x	x						Medium	Medium	-	\$210,000	Outsourced O&M services (2 SCADA technicians)
SF-4.11	SCADA internal staff : Train two electrotechnical staff per branch to do SCADA maintenance	OP1	SF-4.6 GII-4.4 GII-4.5 GII-4.7 GII-4.8 GII-4.9		x									High	Medium	\$14,400	-	Training by branch
SF-5	Continuous improvement															\$3,200	\$29,200	
SF-5.1	Implement change management practices (training, awareness campaign for all staff) to (re)implement a reporting culture by imposing standard regular reports on operations: daily production, etc.	GOV2 SA1	SF-1.5	x	x	x	x	x						High	Medium	-	\$29,200	Monthly support + Internal digital forum
SF-5.2	Implement change management practices (team building activities, workshops, cybersecurity awareness campaign for all staff, user feedbacks) to introduce the digital culture, with priority given to district operations teams	GOV2 SA1	SF-1.5	x	x	x	x	x						High	Medium	-	-	shared costs with SF-5.1 consultancy
SF-5.3	Share end-users manuals (ERP, GIS, etc.)	IT2 GOV3	SF-1.1 SF-2.1 SF-2.2		x	x	x	x						High	Low	\$3,200	-	Mainly performed by Internal staff + external support

Action code	Action description	Related Maturity Grid Objective	Prerequisites	2	2	2	2	2	2	2	2	2	2	Priority	Complexity	CAPEx	OPEx	Description
				0	0	0	0	0	0	0	0	0	0					
				2	2	2	2	2	2	2	2	2	2					
				5	6	7	8	9	0	1	2	3	4					
GENERAL IT/OT IMPROVEMENT																\$3,611,140	\$43,200	
GII-1	ERP improvement															\$312,700	\$37,200	
GII-1.1	Statute on the legal obligations regarding the ministry guidelines to keep paper versions of documents (concerning expenses, contracts, purchases, etc), remove superfluous paper circuits, and formalise mandatory paper-based validation workflow	SA3	SF-2.1 SF-2.2	x										High	Low	\$22,500	-	Mainly performed by Internal staff + external support (including on-site mission)
GII-1.2	Complete the ERP assessment provided in the Diagnostic report (Chapter 1) to detail its limitations in order to upgrade it (missing data flow and/or modules, additional accesses to be provided, digital validation workflow)	SA3	GII-1.1	x										High	Medium	\$40,000	-	Consultancy (diagnostic + recommendations) including on-site mission
GII-1.3	Upgrade the current ERP (Microsoft Dynamics NAV to Microsoft Business Central) as Microsoft Dynamics NAV will soon be obsolete	IT2	SF-2.1 SF-2.2 SF-3.8	x	x									High	Medium	\$231,000	\$37,200	ERP development, testing, support, running External support for project management Licence renewal
GII-1.4	Based on the conclusion of the assessment, upgrade ERP to: - integrate new modules (Ex: purchase requests, tenders database, document management system, HR modules, contract management, helpdesk) - create dataflows between ERP and other software (Ex: CMMS, GIS, and Time Attendance system) - create the required digital validation workflows (for a proper data control and validation of key documents)	SA3	GII-1.2	x	x	x	x							High	High	-	-	Included in GII-1.3 consultancy
GII-1.6	Configure user rights, linked to authorization levels previously defined	IT2	GII-1.2 GII-1.3 GII-1.4	x										High	Low	\$1,600	-	Performed by internal staff

Action code	Action description	Related Maturity Grid Objective	Prerequisites	2	2	2	2	2	2	2	2	2	2	Priority	Complexity	CAPEX	OPEX	Description
				0	0	0	0	0	0	0	0	0	0					
				5	6	7	8	9	0	1	2	3	4					
GII-1.7	Provide access to the ERP to the identified new users (branches managers)	SA1 GOV3	GII-1.2 GII-1.3 GII-1.4	x										High	Low	-	-	Performed by internal staff
GII-1.8	Train new ERP users - Basics All departments to benefit from the ERP experience (positive feedback, training, mentoring)	GOV2 SA1	GII-1.6 GII-1.7	x	x									High	Low	\$16,000	-	Training of new users (only a sample of employees --> Train the trainer concept)
GII-1.9	Create procedures and/or update existing ones to adapt them to the changes to ERP (Ex: Time attendance monitoring, revenue conciliation, purchases requests, warehouse management ,etc)	IT2 SA1 SA3	GII-1.8	x	x	x	x							Medium	Medium	-	-	detailed in actions: SPI-1.6, SPI-1.9, SPI-2.5, SPI-3.1, SPI-4.8, SPI-14.4, SPI-16.3, SPI-17.2.
GII-1.10	Train ERP users to the new procedures	SA1 SA3	GII-1.9	x	x	x	x							Medium	Low	-	-	detailed in actions: SPI-1.6, SPI-1.9, SPI-2.5, SPI-3.1, SPI-4.8, SPI-14.4, SPI-16.3, SPI-17.2.
GII-1.11	Insert the existing ERP user manual in the relevant ERP module	SA1	GII-1.3 GII-1.8 GII-1.10	x	x									Medium	Low	\$1,600	-	Performed by internal staff
GII-2	Document and process Management System															\$0	\$0	
GII-2.1	Implement a Document management system (DMS) - training, procedures, organisation	SA3	GII-1.2 GII-1.5		x									Low	Low	-	-	Included in GII-1.4/1.5
GII-3	KPI Management															\$17,500	\$0	
GII-3.1	Identify the reporting needs, regarding national guidelines for WEs performance monitoring, that could be covered by an automatic ERP export	GOV4	GII-1.4 & 1.6	x										Medium	Medium	\$17,500	-	Consultancy (diagnostic + recommendations) including on-site mission
GII-3.2	Identify the reporting needs that could be covered by an automatic ERP report (dashboard).	GOV4	GII-3.1 GII-1.4 & 1.6	x										Medium	Medium	-	-	Included in GII-1.2; 1.4/1.5

Action code	Action description	Related Maturity Grid Objective	Prerequisites	2	2	2	2	2	2	2	2	2	2	2	Priority	Compl exity	CAPEx	OPEx	Description
				0	0	0	0	0	0	0	0	0	0	0					
				5	6	7	8	9	0	1	2	3	4						
GII-3.3	Update the ERP to automatically generate the mandatory KPIs (dashboard)	GOV4	GII-3.1 GII-1.4 & 1.6	x											Medium	Medium	-	-	Included in GII-1.2; 1.4/1.5
GII-4	SCADA infrastructure improvement																\$3,280,940	\$6,000	
GII-4.1	Create and Maintain detailed asset list of SCADA equipment to be hosted in the ERP inventory module	OP1 OP2 PS2	GII-1.4	x	x											High	-	-	Included in SPI-10.1
GII-4.2	Centralise electronically all document related to SCADA equipment and previous implementation, to be hosted in the DMS	OP1 OP2	GII-2.1	x											Low	Low	-	-	Included in SPI-10.1
GII-4.6	Implement works and procedures to protect the SCADA system against vandalism and cyber attacks	OP1 OP3				x									Medium	Low	\$18,340	-	Consultancy (audit + support to implementation of physical & logical protection + SOPs)
GII-4.7	Improve the SCADA by implementing technical enhancement	OP2 OP3		x	x										Medium	Low	\$62,600	\$6,000	Consultancy (optimisation of IOs to be sent to supervision) Procurement (bulk meters installation, security system improvement, etc)
GII-4.8	Carry out the planned implementations of SCADA in the next phases	OP1 OP2 OP3		x	x	x	x	x							Medium	Medium	\$3,200,000	-	Purchase of equipment Consultancy

Action code	Action description	Related Maturity Grid Objective	Prerequisites	2	2	2	2	2	2	2	2	2	2	Priority	Complexity	CAPEX	OPEX	Description
				0	0	0	0	0	0	0	0	0	0					
				5	6	7	8	9	0	1	2	3	4					
SPECIFIC PROCESS IMPROVEMENT																\$1,461,300	\$623,240	
SPI-1	Support for Customer management/ internal process															\$132,400	\$510,000	
SPI-1.2	Implement eSignature for new contract management	CR1 CR2	GII-1.4 SF-1.4 SF-1.5	x										Medium	Medium	\$40,000.00	\$10,000.00	Esignature implementation (licence and external support)
SPI-1.3	Digitalise paper-based contract to the customer database (Purchase scans if necessary - not included in the budget estimate)	CR1 CR2	SF-1.4 SF-3.2		x									Low	Medium	\$1,500	-	Mainly performed by Internal staff + external support
SPI-1.5	Set up a special team responsible for updating the customer database: provide a simple reliable tool (project CRP1), train the field teams (fraud control, specific team if necessary) and formalise the task of updating the database	CR1 CR2	SF-1.4 SF-1.5 SF-2.2	x	x									High	High	\$22,500	-	SOPs development + Training
SPI-1.6	Streamline procedures for Customer information update (regularisation, payments monitoring, etc.) in line with the new tools, and update customer database	CR1 CR2	SF-1.4 SF-1.5 SF-2.2	x	x									High	Medium	\$22,500	\$500,000	SOPs development + Training Optional: On-the-field support for regularisation campaign
SPI-1.7	Integrate the customer information (from the ERP) in the GIS Train commercial staff (specialised team) on the utilisation of GIS data for customer regularisation	CR1 CR2	SF-2.2 SPI-1.5					x						Low	High	\$21,400	-	Consultancy (Integration of the customer information in the GIS) Training

Action code	Action description	Related Maturity Grid Objective	Prerequisites	2	2	2	2	2	2	2	2	2	2	Priority	Complexity	CAPEx	OPEx	Description
				0	0	0	0	0	0	0	0	0	0					
				5	6	7	8	9	0	1	2	3	4					
SPI-1.9	Provide access to CRM system at branches level and configure authorization levels Streamline procedures for CRM system use at branch level (offices must be able to handle basic customer complaints)	CR3	SF-1.4			x	x							Medium	Medium	\$24,500	-	SOPs development + Training Configuration of authorization levels (can be performed by internal staff or external support)
SPI-2	Customer journey improvement															\$84,900	\$8,440	
SPI-2.1	Streamline communication channels via Customer Service Portal (website, mobile application)	CR3 CR4	SF-1.4			x								Medium	Low	\$3,000	-	Mainly performed by Internal staff + external support
SPI-2.2	Extend the Customer Service Portal features in order to address other stages of the customer journey (subscription, termination of subscription, online payments, etc.)	CR3 CR4	SF-1.4 SPI-2.1 SPI-4.5			x	x							Medium	High	\$54,400	\$5,440	Technical assistance to develop additional modules (interactive interface, integrations, etc)
SPI-2.3	Develop the WE website, if necessary, to include access to the customer service portal functionalities; and publish it	CR3 CR4	SPI-4.5			x	x							Medium	Medium	\$5,000	\$3,000	Website development, hosting cost and maintenance
SPI-2.5	Create SOP to streamline Customer relation Train all commercial staff to the new tools and procedures	GOV2 CR3	SPI-2.1 SPI-2.2 SPI-2.3			x	x	x						Medium	Low	\$22,500	-	SOPs development + Training
SPI-3	Billing management															\$22,500	\$0	
SPI-3.1	Create SOP to streamline billing and train staff	GOV2 CR3	SF-1.4 SF-2.2	x										High	Low	\$22,500	-	SOPs development + Training
SPI-3.2	Implement a dashboard to support debt management (late payers, unpaid amount, X months overdue, etc.)	GOV4 CR2	GII-1.3 GII-1.4 SPI-3.1		x									High	Medium	-	-	Included in GII-3.2

Action code	Action description	Related Maturity Grid Objective	Prerequisites	2	2	2	2	2	2	2	2	2	2	Priority	Complexity	CAPEx	OPEx	Description
				0	0	0	0	0	0	0	0	0	0					
				5	6	7	8	9	0	1	2	3	4					
SPI-4	Collection management															\$69,500	\$2,000	
SPI-4.2	Implement a mobile tools for on-the-field revenue collection, communicating with the ERP (smartphones, mobile printers)	CR2 SA1 SA2	GII-1.3 GII-1.4		x									Medium	High	\$36,000	\$2,000	Procurement of mobile printers Software development to link to the ERP
SPI-4.3	Diversify the channels of payments thanks to improved Customer Portal Service and mobile app (online payment)	CR3 SA2	GII-1.3 GII-1.4 SPI-2.3				x							Medium	Medium	-	-	Included in SPI-2.2 and SPI-2.3
SPI-4.5	Finalise the customer portal (application or website - CRP2) for customer application and payment	CR3 SA1 SA2	SPI-2.3			x								Medium	Medium	-	-	Included in SPI-2.3
SPI-4.6	Maximise the use of the e-payment through communication campaigns	CR3 CR4	SPI-4.5			x	x							Medium	Low	\$3,000	-	Mainly performed by Internal staff + external support
SPI-4.7	Connect the ERP to bank systems and government tax department	SA2	GII-1.3 GII-1.4				x							Medium	Low	\$8,000	-	Purchase of Next system (for instance)
SPI-4.8	Streamline cash collection procedures and train all commercial staff to the new tools and procedures	CR2 SA1 SA2 GOV2	SPI-4.2 SPI-4.3 SPI-4.5					x						Medium	Low	\$22,500	-	SOPs development + Training
SPI-5	Metering management															\$505,000	\$10,000	
SPI-5.2	Deploy customer water metering for large consumers	CR2 CR3 SA2	SF-1.4 SPI-5.1					x						Low	Medium	\$500,000	\$10,000	Technical assistance (water metering strategy redaction & deployment) Meter installation & data management Meter maintenance & renewal

Action code	Action description	Related Maturity Grid Objective	Prerequisites	2	2	2	2	2	2	2	2	2	2	Priority	Complexity	CAPEx	OPEx	Description
				0	0	0	0	0	0	0	0	0	0					
				5	6	7	8	9	0	1	2	3	4					
SPI-5.4	Develop a meter fleet management database	SA2					x							Low	Low	\$5,000	-	Technical assistance to development the database (basic on excel)
SPI-6	Production management															\$22,500	\$0	
SPI-6.1	Streamline data acquisition procedures for volume production KPIs monitoring	GOV4 OP2		x										High	Low	\$22,500	-	SOPs development + Training
SPI-7	Energy management															\$15,000	\$0	
SPI-7.3	Install Energy measuring units for detailed energy monitoring linked to the SCADA	OP2	GII-4.8		x	x	x	x	x					High	Low	-	-	Included in the SCADA implementation GII-4.8
SPI-7.4	Develop energy consumption monitoring (energy efficiency KPIs) and management in line with the new SCADA	OP2 GOV4	SPI-7.3			x	x	x	x					Medium	Medium	-	-	
SPI-7.5	Train O&M staff on the use of SCADA system for energy consumption management	OP1	SPI-7.4			x	x	x	x					Medium	Low	\$15,000	-	Training
SPI-8	NRW Management															\$87,000	\$2,000	
SPI-8.1	Consolidate water production and consumption data to calculate NRW KPIs (physical losses)	OP2 GOV4	GII-4.7 GII-4.8 SPI-5.2				x							High	Medium	-	-	Included in GII-3.2, GII-3.3
SPI-8.2	Develop & implement the illegal connections and consumptions management procedures, and provide the required digital tool (dedicated module in the ERP, automatic work orders, on-device tracking tools)	OP1 CR2	SF-1.4 GII-1.4 SPI-8.1			x								Low	High	\$87,000	\$2,000	Consultancy (structuring of the teams, mandate needs for resources, members, activities, procedures) Purchase of on-device tracking tools (+maintenance costs) & software

Action code	Action description	Related Maturity Grid Objective	Prerequisites	2	2	2	2	2	2	2	2	2	2	Priority	Complexity	CAPEx	OPEx	Description
				0	0	0	0	0	0	0	0	0	0					
				5	6	7	8	9	0	1	2	3	4					
SPI-9	Water quality															\$38,000	\$24,000	
SPI-9.1	Set up a shared water quality database with the top-management. Streamline reporting procedures.	OP2	-	x										High	Low	\$10,000	-	Mainly performed by Internal staff + external support
SPI-9.2	Integrate Water Quality KPIs on the KPI monitoring platform	GOV4	SPI-9.1	x										Medium	Medium	-	-	Performed by internal staff
SPI-9.3	Implement LIMS	SA2	-						x	x				Low	High	\$28,000	\$24,000	Purchase of licences & development to link it to the ERP
SPI-10	Asset management: Inventory management															\$218,500	\$24,000	
SPI-10.1	Carry out an inventory of the current equipment, including SCADA related assets (cf. GII-4.1)	PS1	-	x	x									High	Medium	\$8,000	-	Mainly performed by Internal staff + external support
SPI-10.2	Implement a CMMS (inventory module of equipment and Instrumentation & Control equipment) (SEURECA strongly advises to take inspiration from what has been done on SLWE to develop it.)	PS2 WM1 (WM2 only NLWE)	SPI-10.1 GII-1.3	x	x									High	Medium	\$156,000	\$24,000	Consultancy (technical specifications, support to deployment, development) Purchase of licences & technical support Training of the teams (Train the trainer approach)
SPI-10.4	Update GIS database to create an exhaustive inventory of networks	PS1	SPI-10.1	x										High	Medium	-	-	Performed by internal staff
SPI-10.5	Implement SOPs to update UG assets information in the GIS and AG assets information in CMMS	PS1	SPI-10.2 SPI-10.4	x										High	Low	\$22,500	-	SOPs development + Training

Action code	Action description	Related Maturity Grid Objective	Prerequisites	2	2	2	2	2	2	2	2	2	2	Priority	Complexity	CAPEX	OPEX	Description	
				0	0	0	0	0	0	0	0	0	0						0
				5	6	7	8	9	0	1	2	3	4						
SPI-10.6	Make the GIS more largely available for the different departments (maintenance, operation...)	PS1	SPI-10.4 SPI-10.5		x									Medium	Low	-	-	Performed by internal staff	
SPI-10.7	Create automatic dataflows (assets condition) between GIS and ERP (Fixed assets database) and CMMS and ERP (Fixed assets database)	PS3 WM3	SPI-10.2 SPI-10.4 SPI-10.5				x	x						Low	High	\$32,000		Software development	
SPI-11	Asset management: Corrective maintenance																\$38,500	\$7,800	
SPI-11.1	Implement a CMMS (work orders management module) (SEURECA strongly advises to take inspiration from what has been done on SLWE to develop it.)	WM1 (WM2 only NLWE)W M4	SPI-10.2	x	x									High	Medium	-	-	Included in SPI-10.2	
SPI-11.2	Implement a mobile application for interventions reporting communicating CMMS and SIG	PS1 PS2	SPI-10.2 SPI-10.4 SPI-11.1			x								Medium	Medium	\$16,000	\$7,800	Purchase of licence and development of software to integrate it to the ERP (ex: Kizeo)	
SPI-11.3	Streamline interventions reporting procedures in line with the news digital tools and train end users in the field to ensure a reliable database update	PS1 PS2 PS3 SA3	SPI-11.1		x	x	x							High	Low	\$22,500	-	SOPs development + Training	

Action code	Action description	Related Maturity Grid Objective	Prerequisites	2	2	2	2	2	2	2	2	2	2	Priority	Compl exity	CAPEx	OPEx	Description
				0	0	0	0	0	0	0	0	0	0					
				5	6	7	8	9	0	1	2	3	4					
SPI-12	Asset management: Preventive Maintenance															\$146,500	\$0	
SPI-12.1	Configure basic preventive maintenance rules in the CMMS	WM1 (WM2 only NLWE) WM4	SPI-10.1 SPI-10.2				x	x						Medium	High	\$124,000	-	Consultancy (definition of preventive maintenance rules for critical assets) including on-site mission Technical support to configure the CMMS
SPI-12.1	Streamline preventive maintenance procedures in line with the news digital tools and train users	PS1 PS2 PS3 SA3	SP-11.1 (evtl. 10.2) SPI-12.1						x					Low	Medium	\$22,500	-	SOPs development + Training
SPI-13	ICT management															\$0	\$0	
SPI-13.1	Implement an incident management tool (helpdesk work orders) and write procedures	IT1	SF-2.1 SF-2.2			x								Low	Medium	-	-	Included in GII-1.2; 1.4/1.5
SPI-13.2	Create a list to track the existing hardware, with the date of installation, last update, and usernames	IT1 IT3	SF-2.1 SF-2.2	x										High	Low	-	-	Performed by internal staff
SPI-13.3	Complement the list of existing software, with the version, number of licence, usernames and rights	IT1	SF-2.1 SF-2.2	x										High	Low	-	-	Performed by internal staff
SPI-13.5	Create a list to track the ongoing projects, with the description of the objective, the key contacts, the CAPEX, the OPEX, the delivery date and progress	IT1	SF-2.1 SF-2.2	x										High	Low	-	-	Performed by internal staff
SPI-13.6	Include in the weekly backup the operational data and not only the VM in case the daily backup gets corrupted		SF-2.3 SF-2.5	x										High	Low	-	-	Performed by internal staff
SPI-14	Knowledge and HR management															\$15,000	\$0	
SPI-14.1	Finalise handpunch connection or develop mobile application to substitute time management system.	HR1	GII-1.3 GII-1.4				x							Medium	Medium	-	-	Technical support for software development

Action code	Action description	Related Maturity Grid Objective	Prerequisites	2	2	2	2	2	2	2	2	2	2	Priority	Complexity	CAPEX	OPEX	Description
				0	0	0	0	0	0	0	0	0	0					
				5	6	7	8	9	0	1	2	3	4					
SPI-14.3	Improve ERP HR module (attendance and leaves monitoring, automatic issuing of payslips, training monitoring, etc.)	HR1 HR2	GII-1.3 GII-1.4			x								Low	Low	-	-	Included in GII-1.4/1.5
SPI-14.4	Strengthen HR procedures in line with the new ERP modules & train users	GOV3	SPI-14.3			x								Low	Low	\$15,000	-	SOPs development + Training
SPI-15	Fleet management															\$0	\$0	
SPI-15.1	Implement fleet management in CMMS	WM1	SPI-10.1 SPI-11.1							x				Low	Low	-	-	Included in SPI-11.1
SPI-16	Tender management and Purchase															\$38,500	\$0	
SPI-16.1	Improve the ERP supplier platform to enable to track the communications (and paper doc only if required)	SR1	GII-1.3 GII-1.4						x					Low	Medium	\$16,000	-	Included in GII-1.4/1.5
SPI-16.2	Digitalise the purchase request process (e.g. purchase / stock)	SR3	GII-1.4				x							Low	Medium	-	-	Included in GII-1.4/1.5
SPI-16.3	Update procurement procedures to adapt them to new digital tools & Train staff	SR2	SPI-16.1 SPI-16.2				x	x						Low	Low	\$22,500	-	SOPs development + Training
SPI-17	Manage Accounting and Control															\$0	\$0	
SPI-17.1	Make accessible the ERP to the Control department staff	SA1			x									Medium	Low	-	-	Performed by internal staff
SPI-18	Technical Project Management															\$27,500	\$35,000	
SPI-18.2	Increase human resources in line with the investment program							x						Low	Medium	-	-	not quantified: investment projects should be accompanied by recruitment commensurate with their number and size.

Action code	Action description	Related Maturity Grid Objective	Prerequisites	2	2	2	2	2	2	2	2	2	2	Priority	Complexity	CAPEx	OPEx	Description
				0	0	0	0	0	0	0	0	0	0					
				5	6	7	8	9	0	1	2	3	4					
SPI-18.3	Improve skills in use of modelling software and CAD		SPI-18.2 SPI-18.5					x						Low	Low	\$22,500	-	Training
SPI-18.4	Make accessible the existing BWE tools to the Stations and Projects Department (SCADA/GIS)			x										High	Low	-	-	Performed by internal staff
SPI-18.5	Get necessary design tools to carry out projects (autoCAD, waterCAD, etc..)		SPI-18.2				x							Low	Low	\$5,000	\$35,000	Purchase of licence

4.3. FOCUS ON THE NECESSARY INVESTMENTS

The implementation of this ambitious transformation roadmap will require external financial support and the resources currently generated by the utility are not sufficient to self-finance the proposed improvement. Hence, SEURECA provided a **quick estimate of the budgets related to each of the main initiatives proposed in order to assist BMLWE in initiating discussions with its financial partners.**



GROUPING ACTIONS IN PACKAGES TO REDUCE COSTS

It is worth noting that, in the budget estimates presented in the table above, several actions have been presented separately (e.g. the various customer management training courses) to facilitate understanding of the approach. However, these actions must be carried out together to ensure consistency in team training, which tends to reduce their overall cost.

Example of grouped action within the establishment:

- Customer Management processes and diverse ERP improvement
- Hardware updates
- Commercial trainings

Examples of joint actions by the 4 establishments:

- CMMS development: standards, templates, SOPs
- Technical trainings
- KPIs definition

Regarding training, SEURECA recommends drawing up a Training plan, integrating the various themes specific to each business process, to ensure overall consistency in team skills enhancement and to facilitate implementation follow-up.



BUDGET ESTIMATES AND NEEDS FOR INTERNAL STAFF REINFORCEMENT

SEURECA has considered that in the mission carried out by the AFD entitled "Organigrams, Roadmap & Action Plan proposed for the Water Establishments, Organisation and Human Resources", the size of the teams would eventually enable the aim of operational quality of water services to be achieved (not only Digitalisation), in line with the ambitions of the Ministry and the establishments.

The support provided by external experts or diverse development needs (project management, training, support in drafting and implementing procedures, support to definition of needs for new tools, etc.) is included in the financial estimates and will enable staff to improve staff's skills and the level of digitalisation of the WE.

It is worth noting that, in the budget estimates, the internal staff reinforcement (salary costs) has not been included.

Therefore, certain aspects of digitisation require an assessment to evaluate the possibility of

recruiting new staff in order to face the new needs (e.g. SCADA experts, call centre).

The necessary **CAPEX investments** for BWE action plan implementation are up to **6,225 k\$**, which represents around 13% of its yearly turnover (collection). The **yearly additional OPEX** associated with the implementation of the action suggested are up to **907 k\$** (in 2029, considering that all actions have been implemented); which represents (regardless the impact of the change rate) an **increase of about 12% of the current yearly OPEX** of BWE (7 M\$ in 2020)³.

The graph below shows the evolution of CAPEX over the next 5 years, detailing the amount for each category of action. The curve illustrates the percentage of initial budget execution year after year.

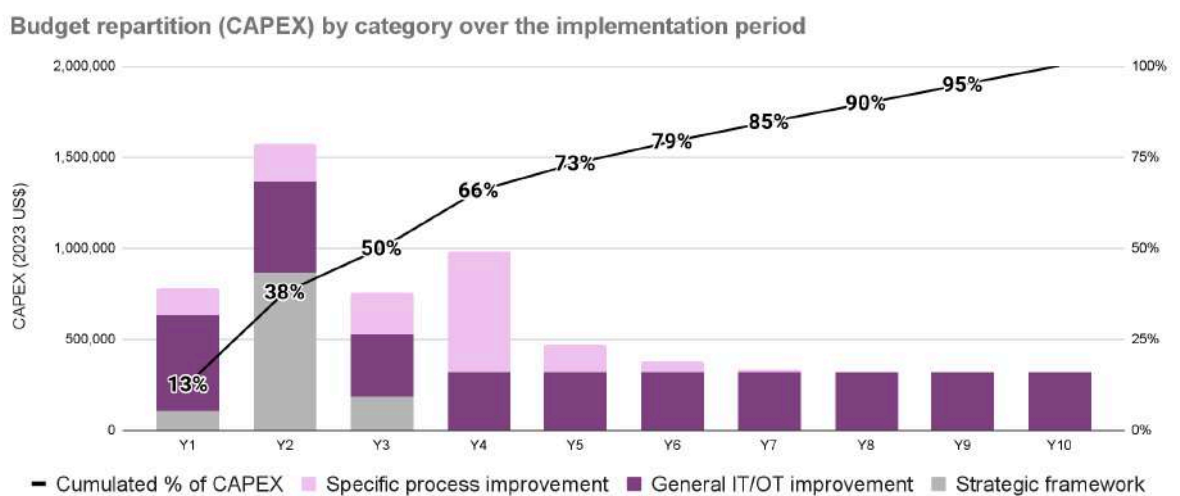


Figure 43: Investments repartition over the implementation period

The budget execution is quite regular over the 5 years. In 2025, it is expected that already 13% of the budget will be used due to the important investment related to the SCADA implementation (671k\$ on the 2 first years related to this project).

During the 3 first years of implementation, the financial effort is mostly focused on structuring the strategic framework in order to prepare the introduction of the new tools and procedures part of the digitalisation strategy.

The investments between 2030 and 2034, are mostly due to:

- the extension of SCADA to all sites of BWE;
- the implementation of a LIMS;
- The implementation of additional modules to the ERP (and the related training & procedures updates): HR, tender database, procurement module, fleet management.

The main sources of expenses are used to:

³ Water Sector 2021 ... Sustain and Grow! Needs and forecast 2021-2024 - Bekaa Water Establishment - June 2021

- **Fill the large gap identified in the operation management** thanks to:
 - The extension of the SCADA to all BWE's installations (following the feasibility study) (General IT/OT improvement);
 - The implementation of a CMMS and the related procedures (Specific process improvement);
- **Strengthen commercial management to increase revenues (quick wins)** thanks to:
 - The implementation of metering for large customers (Specific process improvement);
 - The campaigns of customer regularisation to update customer database (Specific process improvement);
- **Support all operations and overall performance by having a reliable IT architecture** thanks to:
 - The implementation of the measures resulting from the audit of the Business Continuity Plan (Strategic framework);
 - The update of the ERP (General IT/OT improvement).

Planned investments are mainly due to the **contracting of external experts** (technical assistance, software development, etc.) which represents **37% of the total investments** and the **purchase of hardware and software** which represents **63% of the total investments**.

CAPEX repartition by category of investment over the implementation period

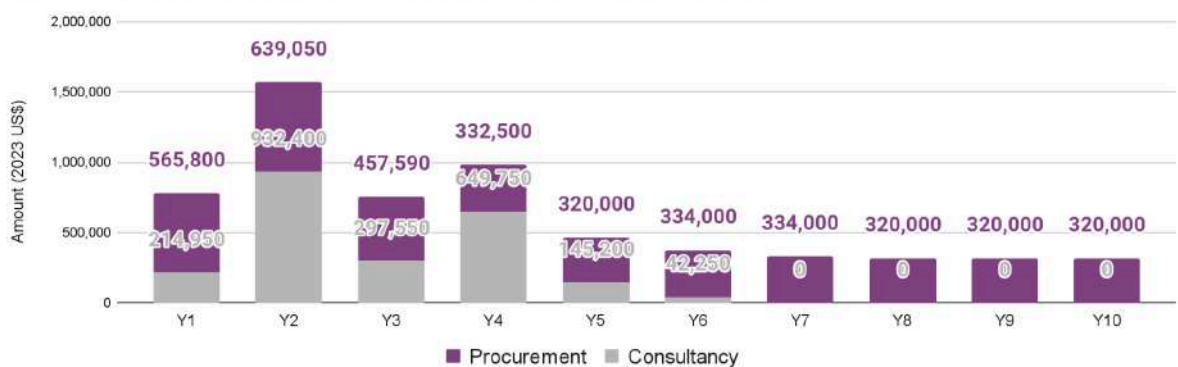


Figure 44: Investments repartition regarding the category over the implementation period

The consultancies (Technical Assistance) are mostly implemented during the first years of implementation as they enable to structure the teams, design the specification of the equipment to purchase, and prepare the handling of the new tools (by adapting the procedures and carrying out training of the teams).

4.4. RISKS AND FACTOR OF SUCCESS

4.4.1. RISK ANALYSIS & MITIGATION

A risk analysis below highlights the potential threats to the success of the action plan implementation, as well as the mitigation actions to avoid or limit these risks.

Risk identified	Proba	Impact	Level of Risk	Mitigation measures
Geopolitical conflicts that can slow down / stop the implementation of certain projects			High	Breaking down the actions into smaller ones to ensure the completion. Establish partnerships with a wide range of local and international players. This will reduce dependence on a single partner or source of funding and expertise.
Lack of financial resources			High	Share the costs of certain investments (joint training between the different establishments). Rely as much as possible on modules/solutions already developed in other establishments (copy and adapt). "Train the trainer" approach to reduce the training costs In the case of IFI support, include an overall long-term budget for the actions undertaken (including OPEX over 5 years, for example), even if this means limiting lower-priority projects.
Lack of human resources			High	The use of external Technical Assistance to complement unfilled positions.
Resistance to change			Moderate	Communicate clearly and regularly with employees and stakeholders about the benefits of the digital strategy and the reasons for change. Involve employees in the decision-making process and encourage them to voice any concerns or suggestions. Provide adequate training and support to help employees adapt to new processes and technologies. Implement recognition and motivation programmes to encourage adoption of the digital strategy.
Data security			Medium	Implement robust security protocols, such as firewalls, antivirus and intrusion detection software. Regularly backup data and store it in secure locations. Train staff in good security practices, such as the use of strong passwords and awareness of phishing attacks. Establish policies for managing access to data and appropriate authorisations.

Risk identified	Proba	Impact	Level of Risk	Mitigation measures
Regulatory compliance risk	Yellow	Red	Medium	Put in place monitoring and reporting processes to demonstrate compliance to the relevant regulatory authorities.

Table 18: Risk matrix and mitigation measures

4.4.2. SUCCESS FACTOR

Resulting from the risks analysis, some key factors of success for an efficient digital transformation of the water establishment have been identified:




A TECHNICAL ASSISTANCE TO SUPPORT BMLWE IN IMPLEMENTING THE FIRST STEPS OF THE STRATEGY

Considering the ambition of the digital transformation strategy as well as the insufficient financial means to recruit/train/purchase according to the plan, it is highly recommended that Technical Assistance be put in place to support SLWE in the first 2-3 years of implementation in order to help manage the transition and in particular:

- Get guidance on initiating the various steps of the strategy;
- Benefit from the support of international digital experts from the water business while SLWE recruits its own experts;
- Implement knowledge transfer and organised capacity building;
- Obtain support on preparation of technical specification and tendering processes that may be required for the implementation of the various activities.

The technical assistance would have a real impact if it is carried out by a water expert operator as it would guarantee practical and down to earth implementation of the actions.



CHANGE MANAGEMENT

Change management plays an essential role in the successful implementation of a digital strategy. The importance of change management lies in its ability to **deal effectively with the human aspects of change** within an organisation. When new tools or methods are introduced, employees may experience resistance, fear or confusion. By integrating change management, the establishment can mitigate these difficulties and ensure a smooth transition.

Several methods exist to prepare for change:



Communication: Clear and transparent communication is essential to explain the reasons for implementing the digital strategy, the benefits it will bring, and the impact on different roles within the organisation;



Employees involvement: Involving employees in the decision-making process creates a sense of ownership and empowers them to actively participate in the change;



Training and support: Providing adequate training and support ensures that employees have the necessary skills and knowledge to adapt to the new digital strategy;



Risk management: Identifying potential obstacles and developing contingency plans helps in managing risks and minimising disruptions during the implementation process.



ENCOURAGE JOINT INITIATIVES BETWEEN WATER ESTABLISHMENTS

Where possible, SEURECA recommends to:

- **Set up activities bringing together people from different water establishments to maximise impact:** for example, when training is given by international experts, include people from all 3 utilities in the audience;
- **Make maximum use of what has been done in one establishment by replicating it in others:** for example, it would be worthwhile to build on Beirout's SCADA system, which is already well advanced, to set up SCADA systems in other utilities, or to replicate the performance monitoring system from one establishment to another.

This would reduce overall costs, promote knowledge sharing between utilities and standardise water management nationwide.

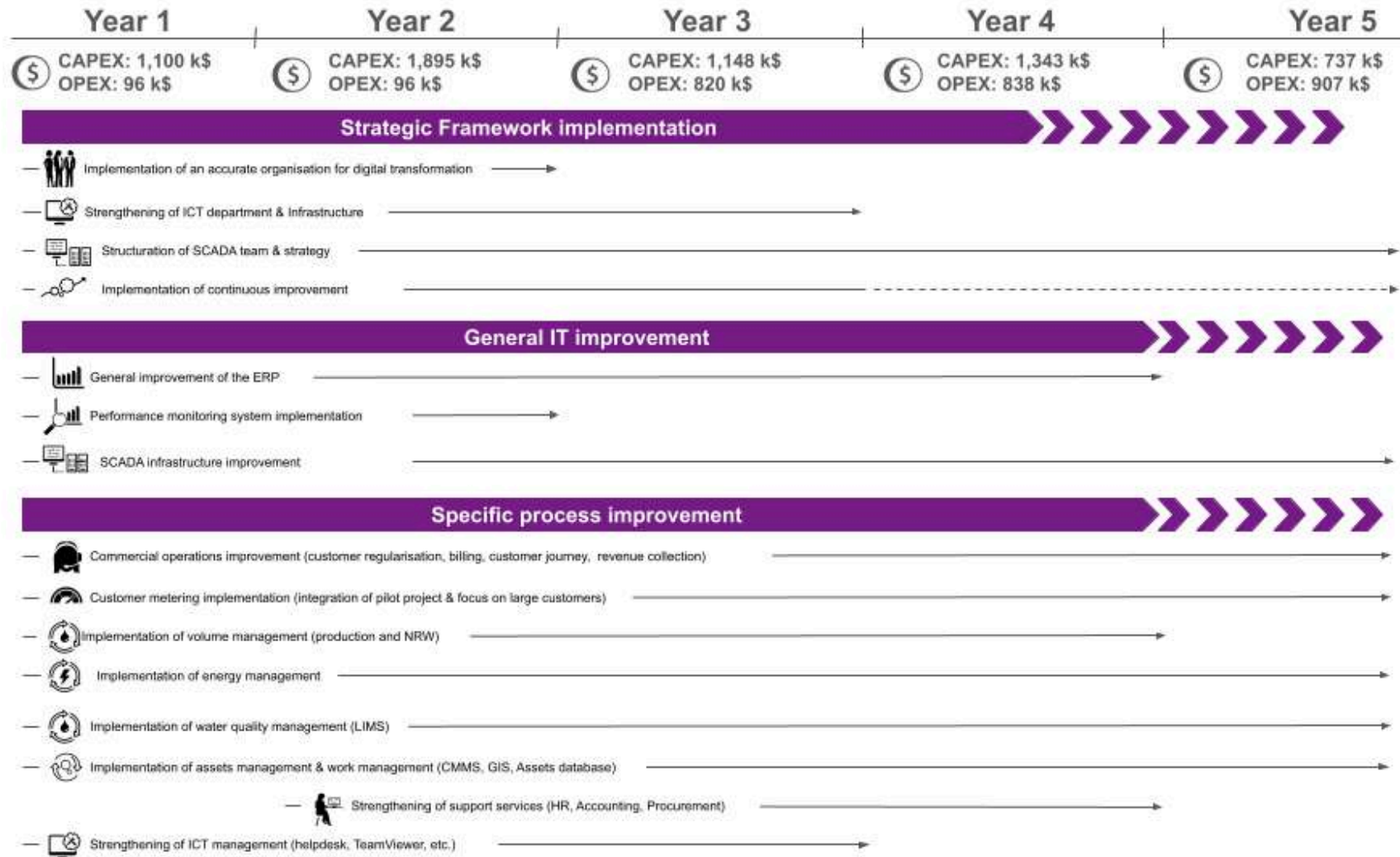


TRAIN THE TRAINER

In order to reduce training costs and encourage water establishments to appropriate the tools and methodologies learned during training sessions, SEURECA proposes to implement the "Train the Trainer" principle. This involves training a selected sample of employees, who will themselves be responsible for training the rest of the teams.

4.4.3. DIGITAL TRANSFORMATION ROADMAP

Resulting from the Action plan, a 5-years roadmap has been designed to summarise the different actions (between 2025 and 2029) and support their implementation.



1.1. 5. NEXT STEPS

Moving forward, SEURECA strongly recommends to start with the implementation of the following actions.

In order to create the ideal environment for BWE's digital transformation, SEURECA recommends to start by implementing the following measures:

- A technical assistance to carry out the overall re-organisation of BWE (SF-1.1, SF-1.2, SF-1.3, SF-1.4, SF-1.5);
- The structuring of the IT department: appointment of the key positions (SF-2.1, SF-2.2, SF-2.3), implementation of policies and procedures and trainings (SF-2.5);
- The provision of additional hardware where required to ensure an accurate working framework for digital transformation (SF-3.1, SF-3.2);
- The structuring of the SCADA team by providing a strategy (SF-4.1) and appointing the relevant members (SF-4.5);
- The launch of the implementation of change management practices (SF-5.1, SF-5.2).

To provide a **framework for the contracting of external technical support and the purchase of software/hardware**, and to ensure that the **solutions are fully tailored to BWE's needs**, SEURECA recommends to start by implementing the following measures:

- A review of operational needs and improvement of the current ERP (GII-1.1, GII-1.2, GII-3.1) to design the technical specifications of the required improvements (new modules, digital validation workflows, etc.) and start at least of the update of the licences (GII-1.3);
- **Securing** the existing SCADA system (GII-4.6) and **expanding it** to the rest of operational sites, following a well-defined strategy (GII-4.8).

SEURECA recommends to **quickly address the critical shortcomings observed in O&M management**, by implementing the following measures:

- The structuring of the overall O&M reporting by providing digital tools & procedures: volume management (SPI-6.1), water quality, (SPI-9.1);
- An **inventory of all assets** of the WE and update or creation of the accurate databases, in order to improve overall asset management (SPI-10.1, SPI-10.4, SPI-13.2, SPI-13.4);
- The launching of the **implementation of a CMMS**, by developing the technical specifications in line with the assessment of the WE's needs (SPI-10.2, SPI-11.1), start by implementing traceability modules to ensure rapid analysis of activity and instil a culture of reporting.

Finally, SEURECA recommends to **quickly implement the actions that could trigger quick wins for the service** (*Those additional incomes could be used for instance to finance the additional OPEX from the action plan implementation.*), as well as:

- Start work on **updating the customer database**, the quality of which is currently a source of potential financial loss and demotivation. At the same time, use the methods already in place to detect illegal connections (mainly in paper form) and meter readings to **update the database on an ongoing basis, in addition to a systematic approach field surveys**;

- Facilitate the digital customer journey and improve payment rates by diversifying payment options, offering methods such as OMT or online payments.

6. APPENDIX

6.1. APPENDIX 1: CUSTOMER JOURNEY

New customer with new connection							
Steps	Arrival of the customer and contact for new connection	Response from the connection department	Acceptance of the quote and return of the information	Execution of the work	Control and reception	Invoicing	Possible claim
Actor/service	O&M department (Admin team)	O&M department (Admin team)	O&M department (Admin team)	O&M department (Admin team)	O&M department (O&M team)	O&M department (Admin team)	Technical department (IT - Calling center) or O&M department (Admin team)
Tasks	First contact	Making and sending the quotation	Signature and acceptance of the quote	Realisation of the works	Validation of the works	Invoicing	Complaints management
Processes and activities	Connections and quotations	Connections and quotations	Connections and quotations	Follow-up of the works	Connections	Billing	Customer satisfaction
Channels - touchpoints	Physical presence in the office (branches)	NA	Physical presence in the office (branches)	Works	NA	Physical presence in the office (branches)	Call centre Customer office with paper note-taking Social Media
Digital bricks used (or not)	NA	NA	NA	NA	NA	ERP Payment trough OMT	Social Media (Facebook) and Call Center
Comments	The client fills in a form and brings expected documentation The customer service team enter the information in the ERP and check if there is previous debt (if previous debt, can be registered until it is paid) The client pays for subscription fees A handwritten receipt is provided	The customer must spontaneously return to the office 20 days after subscribing to find out if he/she is eligible for a connection	Signature of the quotation to be done in the office First payment is done when opening the connection at the office (pro rata of the year)	Intervention tickets are issued manually	When the work is finished, the control committee team visits in the following days to review the work carried out (connection + repair) The client is not informed	Customer pay for the first year (pro rata) - cash or through OMT A handwritten receipt is provided	The call centre is being integrated into the ERP system to track customer complaints. However, there is no ticket tracking at operations level as they don't have access to the ERP.

	Subscriber life (recurrent)								Account closure, termination and transfer			
Steps	Creation of the subscription	Reading	Invoicing	Possible claim	Contract freezing	Modification of the customer profile	Periodic communication	Incidents - interruption of the service	Departure - Arrival of the customer	Metering control	Final invoicing and account closure	Possible claim
Actor/service	O&M department (Admin team)	NA	O&M department (Admin team)	Technical department (IT - Calling center) or O&M department (Admin team)	O&M department (Admin team)	Client	Communication department	Customer Management Department	Client	NA	O&M department (Admin team)	Technical department (IT - Calling center) or O&M department (Admin team)
Tasks	Creation of customer account or update of existing account	NA	Billing	Complaints management	Subscription freezing	Transmission of customer account update information (bank, telephone, etc.)	Regularly inform the customer	Alerting of an urgent or specific problem	Contact	NA	Final invoicing and account closure	Complaints management
Processes and activities	Subscription	NA	Billing	Customer satisfaction	Subscription	Subscription	Customer satisfaction Communication	Customer satisfaction Communication	Subscription - Billing	NA	Invoicing	Customer satisfaction
Channels - touchpoints	Physical presence in the office (branches)	NA	Door to door collector or Physical presence in the office (branches)	Call centre Customer office with paper note-taking Social Media	Physical presence in the office (branches)	Physical presence in the office (branches)	Social Media (Facebook/Instagram)	NA	Physical presence in the office (branches)	NA	Physical presence in the office (branches)	Call centre Customer office with paper note-taking Social Media
Digital bricks used (or not)	ERP	NA	ERP - Email	Social Media (Facebook) and Call Center	ERP	ERP	Social Media (Facebook/Instagram)	NA	ERP	NA	ERP	Social Media (Facebook) and Call center
Comments	The employee uses the subscription form filled by the customer to update the ERP database	NA	Every beginning of the year, invoices are issued and need to be paid within the year. This bill is sent to the customer by email. The client can pay by cash or check, to the collector (door to door collect) or to the branch office, or he can pay through an OMT. Invoices are edited through the ERP and payments are tracked through the ERP. A handwritten receipt is provided to the customer.	The call centre is being integrated into the ERP system to track customer complaints. However, there is no ticket tracking at operations level as they have not been trained in ERP	Maximum 5 years The customer needs to pay a limited amount to freeze the contract. The employee updates the ERP accordingly.	The customer needs to provide all the supporting documents. The employee updates the ERP database accordingly.	The communication department communicated on the on-going projects.	NA	The customer needs to provide all the supporting documents. The employee updates the ERP database accordingly.	NA	It takes 15 days after the office visit for the operator to come and disconnect the pipe	The call centre is being integrated into the ERP system to track customer complaints. Closing claim are mainly done directly to the office.

SEURECA

Mailing address

30 rue Madeleine Vionnet • 93300 Aubervilliers, France

seureca.veolia.com