SEURECA ⦿ VEOLIA

Digital enterprise transformation in Water Establishments
Focus on Beirut Mount Lebanon Water Establishment (BMLWE)

DIGITAL TRANSFORMATION ACTION PLAN
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In partnership with

◯ AFD
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DOCUMENT CONTROL

GENERAL INFORMATION[1]

Project	Digital enterprise transformation in Water Establishments
Document Title	Chapter 1 & 2 - Diagnostic and Action Plan

RECIPIENT

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VERSIONS

n°	Date	Comments	Author	Verified	Approved
1	24/11/23	Digital transformation roadmap Initial Diagnostic	B. Alain	D.Million	F.Lacour
2	18/01/24	Digital transformation roadmap Action Plan	B. Alain	V.Soulard	F.Lacour
3	26/01/24	Digital transformation roadmap 10 years Action plan - VF	B. Alain	V.Soulard	F.Lacour

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ACRONYMS

AFD	Agence Française de développement
BMLWE	Beirut Mount Lebanon Water Establishment
CCTV	Closed-Circuit TeleVision
CMMS	Computerised Maintenance Management System
CPU	Control Process Units
CRM	Customer Relation Management
ERP	Enterprise Resources Planning
GIS	Geographic Information System
HQ	HeadQuarters
HR	Human resources
IFI	International Financial Institutions
IT	Information and Technology
KPI	Key Performance Indicator
MES	Manufacturing Execution System
MS	MicroSoft
NRW	Non-Revenue Water
O&M	Operations & Maintenance
OT	Operational Technology
PLC	Programmable Logic Controllers
RTU	Remote Terminal Unit
SCADA	Supervisory Control and Data Acquisition
SOP	Standard Operating Procedure
VPN	Virtual Private Network

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 Beirut Mount Lebanon Water Establishment (BMLWE) - 292 employees providing water to 403,000 customers, with a total turnover (collection) of 93.7 BLL (62.2 M$) in 2020[2]. This document presents the results of the **digital maturity diagnostic and assessment** carried out in September 2023, as well as the **digital transformation roadmap** that will enable the establishment to improve overall performance and deliver an ambitious level of service.

- 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.
- It suggests a stepwise roadmap, with an associated budget.

OVERALL STRENGTHS AND WEAKNESSES OF **BMLWE** REGARDING DIGITALISATION

As main findings, the diagnosis showed:

- The BMLWE has embarked on a digital transformation journey for years. The **ERP is a central tool**, particularly linking Customer, Finance & Administration departments and has achieved a good level of maturity. However, c**onsidering the operational and technical departments, the situation is unequal**, with an advanced SCADA system that was initially designed but not properly functioning now or basic operational systems or tools missing (ex. CMMS). The overall digital and operational tools strategy is missing in order to liaise all components into one single digital vision.

- BMLWE used to be a leading water utility but while the extensive organisational and technical knowledge is maintained by skilled and experienced staff, the financial stress prevents the BMLWE from pursuing IT projects, renewing digital tools licence and from properly renewing, maintaining the existing "state of the art" infrastructure system (e.g; computer, firewall system). It directly impacts the staff work quality and ultimately quality of service. The water establishment benefits from donor support especially for the ERP development by USAID but this does not allow it to provide a sufficient response to the **current challenges** faced by BMLWE that digital transformation could address. They can be summed up as **a critical lack of**:

  - **A strategic vision of digital as a lever for improving service levels**,
  - **A reliable operational feedback from the field,**
  - **An integrated management of the different business processes** (O&M, commercial, finance, etc.), based on a fluid flow of information between softwares.

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[2] BMLWE Achievements and Future Plans presented by DG Jean Gebran - May 2021

Strengths	Weaknesses
• Overall **skilled** and **experienced staff** from having been an advanced water utility; • **Willingness to do a good job within the staff**, despite financial means and incentives; • **Robust IT** and **OT** infrastructure; • **Staff** open to **digital transformation**; • **Quality** and **security** of the network infrastructure; • **Various digital tools already implemented and used by the employees** (ERP, CRM); • **Comprehensive GIS** and **competent staff to update it.** • **Existing digital tools to facilitate customer journey which could be reactivated** with appropriate maintenance; • **Existing SCADA system** that could be restarted **with limited funds**;	• **Lack of digital strategy vision on digital** • **Lack of reliable operational feedback from the field** → necessity to manually enter the data into the software or no monitoring; • **Lack of fluid and reliable information flow within BMLWE: between the softwares** (automatic dataflows) **and between the departments** (validation and communication) → requires the use of paper forms which triggers errors and waste of time • **Lack of reporting procedures between departments nor software in the O&M department** →hampers the transmission of data to all other departments; • **Limited access to software and digital tools in the branches** (e.g. no access to ERP) --> deterioration in the quality of information reported from the field and in the fluidity of operations (e.g. purchase requests)**.** • **Incomplete SCADA** (not all sites included), which presents **technical inconsistencies between the different systems**, and is **currently out of service** (discontinuity of power supply) • **Incomplete databases;** • **No SCADA skills** in automation available in the Establishment; • **Customer journey to be digitalised** to be a customer-oriented water service; • **Lack of maintenance of hardware and software** due to the lack of financial resources.
Opportunities	Threats
• **On-going AFD project**	• **Economic crisis in Lebanon** which limits the budget available for BMLWE; • **Recent shortcut of the financial aid for maintenance** leads to a serious lack

	of motivation among teams;
	• **Lack of clarity about the legal requirement to keep a paper trail** of every expense/purchase/contract etc, which limits the possibility to move towards a paperless system; • **Very low salaries in the public sector**, making it difficult to retain and recruit skilled profiles.

🔍 FOCUS ON **SCADA**

The Overall SCADA (supervisory control and data acquisition) evaluation has come to the following findings.

BMLWE has several SCADA systems from different generations addressing different installations. The old ones can be found on treatment plants to manage local facilities when the newest was implemented to monitor and control the water network equipment and instruments. **This central supervision**, called Greater Beirut SCADA, **was implemented in 2015** with the ambition to control the overall water production, and improve the operational conditions of more than 20% of its installations. The establishment also had future plans to expand and finally address the whole regional scope. However, the financial situation of the country and the lack of a reliable power supply resulted in the shut down of the Greater Beirut SCADA and the interruption of SCADA extension projects.

The challenge is now to bring back the Greater Beirut SCADA in operational conditions, to upgrade and to extend it in order to improve the operational efficiency and work toward the objective of the establishment of providing a continuous service to consumers. One significant aspect is the consistency among the on-going SCADA projects as some gaps were noted on specifications. In particular details should be given regarding the links to the central SCADA of Greater Beirut such as communications requirements, equipment and instrumentation details and link to the control room control room.

🔍 DIGITAL MATURITY ASSESSMENT OF **BMLWE** 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 BMLWE** 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.).

🔍 DIGITAL TRANSFORMATION ROADMAP

Based on the initial assessment and the target state previously defined, a **tailored 10-years action plan** was developed to guide BMLWE 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;
- **Re-commissioning, rationalisation and extension of the SCADA system**, to overcome the current lack of visibility on production volumes;
- **Implementation of a CMMS** to overcome the current lack of vision on O&M activities and to ensure sustainable asset management;
- **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, e-payment) and **introducing new ones** (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 BMLWE 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 BMLWE 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 BMLWE 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 BMLWE internal staff is not included in the yearly OPEX estimates presented below.*

The necessary **CAPEX investments** for BMLWE action plan implementation are up to **7,200 k$,** which represents around 12% of its yearly turnover (collection). The **yearly additional OPEX** associated with the implementation of the action suggested are up to **910 k$** (in 2034, considering that all actions have been implemented); which represents (regardless the impact of the change rate) an **increase of about 2% of the current yearly OPEX** of BMLWE (51.9 M$ in 2020)[3].

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

Budget repartition (OPEX/CAPEX) over the implementation period
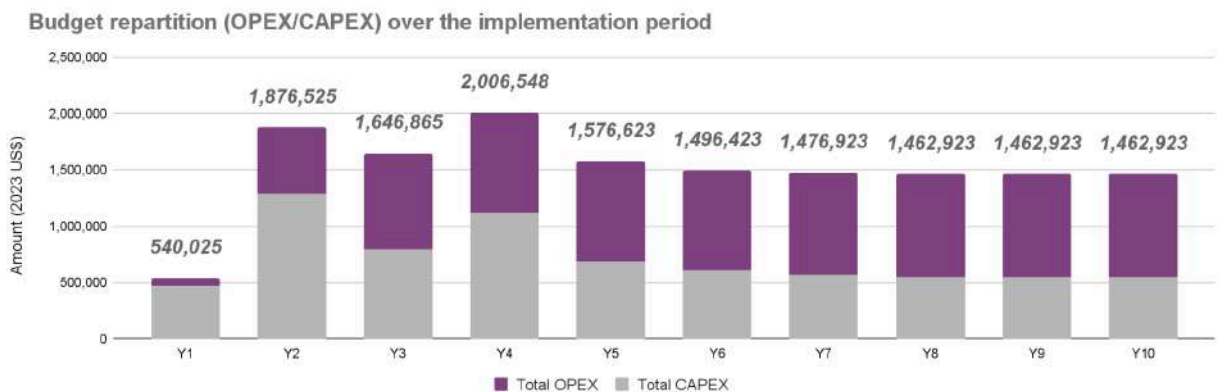
Figure 2: Action plan budget repartition over the 10-years implementation period

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[3] BMLWE Achievements and Future Plans presented by DG Jean Gebran - May 2021

Between years 8 to 10, investments are planned to stabilise at 554 k$ as they will only include the finalisation of the extension of SCADA to all BMLWE 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 BMLWE'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 BMLWE's needs**, SEURECA 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 WE's needs.

Finally, SEURECA recommends to **implement the actions that could trigger quick wins for the service***, such as the migration of the current EBLM subscribers management software customer database to the ERP and the streamlining of the commercial procedures and the provision of accurate digital tools (customer information management, billing, integration of metering pilot projects).

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

Year 1	Year 2	Year 3	Year 4	Year 5
CAPEX: 474 k$ OPEX: 66 k$	CAPEX: 1,286 k$ OPEX: 590 k$	CAPEX: 872 k$ OPEX: 853 k$	CAPEX: 2,549 k$ OPEX: 885 k$	CAPEX: 2,030 k$ OPEX: 907 k$

Strategic Framework implementation

- Implementation of an accurate organisation for digital transformation
- Strengthening of ICT department & Infrastructure
- Structuration of SCADA team & strategy
- Implementation of continuous improvement

General IT improvement

- General improvement of the ERP
- Performance monitoring system implementation
- SCADA infrastructure improvement

Specific process improvement

- Commercial operations improvement (customer regularisation, billing, customer journey, revenue collection)
- Customer metering implementation (integration of pilot project & focus on large customers)
- Implementation of volume management (production and NRW)
- Implementation of energy management
- Implementation of water quality management (LIMS)
- Implementation of assets management & work management (CMMS, GIS, Assets database)
- Strengthening of support services (HR, Accounting, Procurement)
- Strengthening of ICT management (helpdesk, TeamViewer, etc.)

1. INTRODUCTION

1.1. CONTEXT

The "Agence Française de Développement" (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 (SLWE), AFD intends to support the **Beirut Mount-Lebanon Water Establishment** (BMLWE), the **Bekaa Water Establishment** (BMLWE), 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 BMLWE 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 BMLWE;
- 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 BMLWE's management at the end of the mission

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1.3. Overview of the BMLWE

1.3.1. Main information on BMLWE
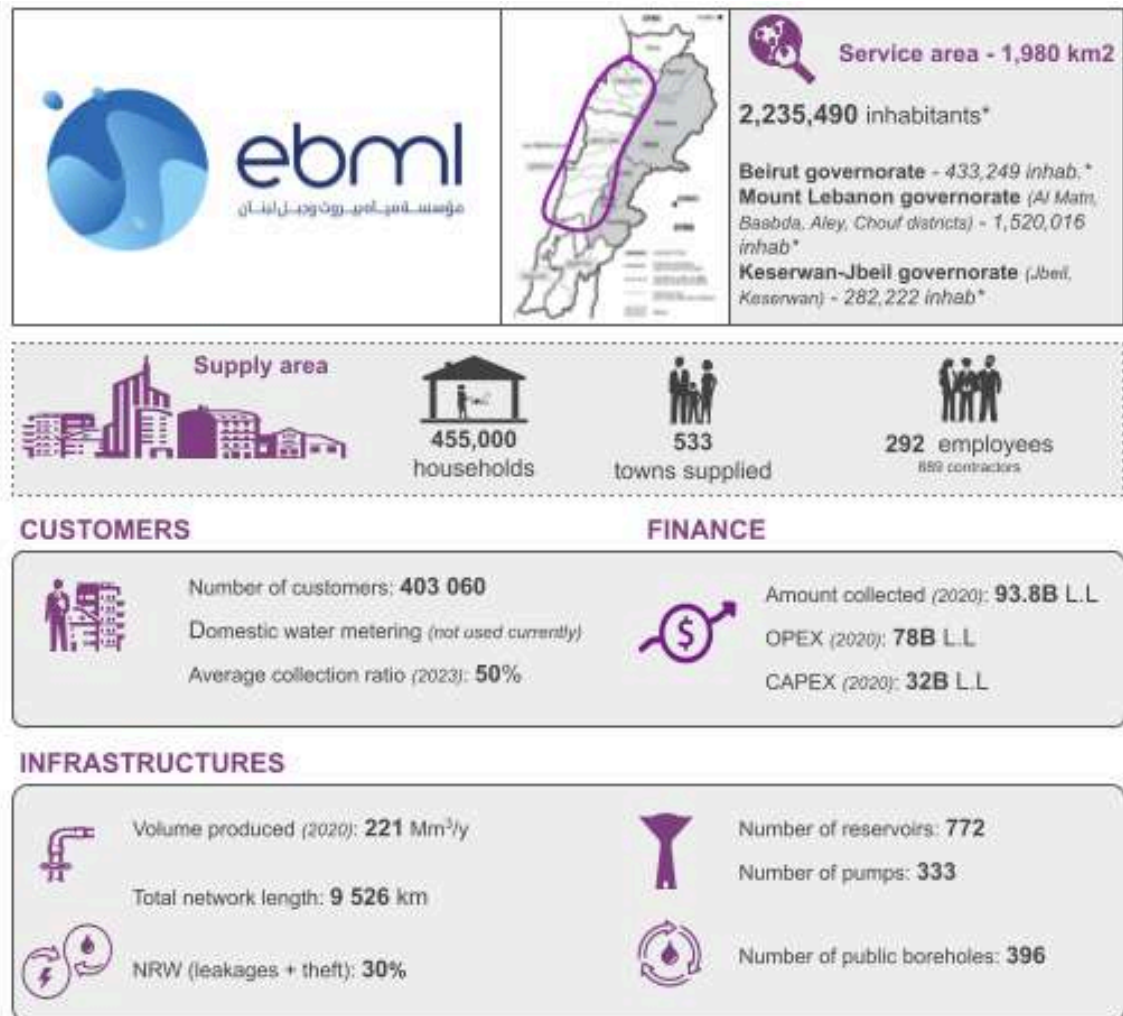
1.3.2. BMLWE's mandate & organisation

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

BMLWE's mandate includes:

- supply of drinking water to the population of the service supply area (see above) and maintenance of the drinking water assets (above ground and networks);
- management of wastewater (excluding rain water) and maintenance of the related assets.

However BMLWE's does not currently operate and maintain the waste water network, as they do not have the competencies and sufficient teams to do it.
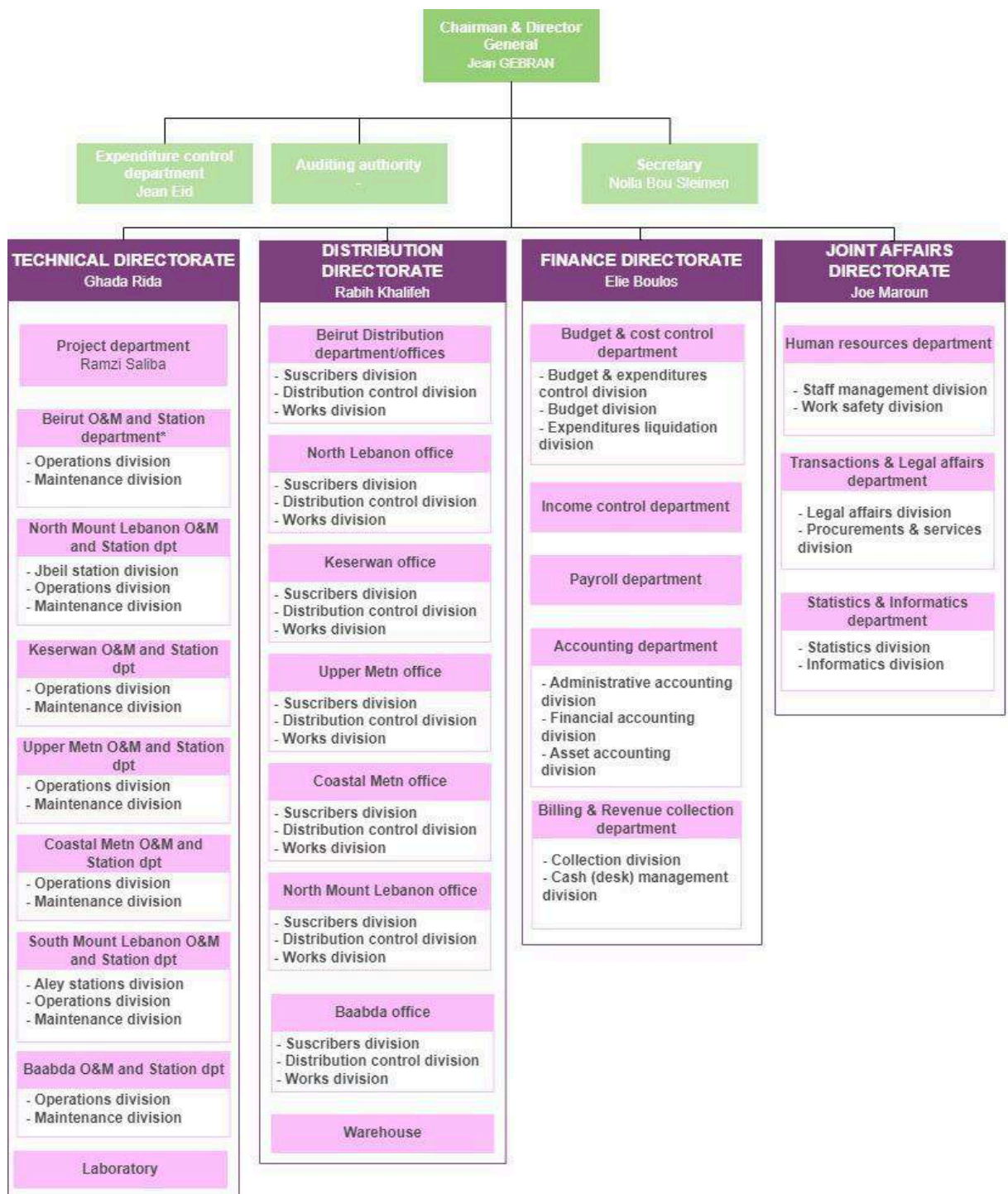
Figure 3: Organisational chart of BMLWE

The organisation of BMLWE is both geographical and functional.

Functional organisation: the departments are divided by function:

- The Technical directorate is in charge of Projects management, O&M of stations and transmission networks, and laboratories;

- The Distribution directorate is in charge of O&M of water distribution network (small repairs on connections, new connections installation, etc.), customer relations management (subscription, complaints management, etc), and warehouses management ;
- The Financial directorate is in charge of finance & accounting (financial reporting, cost & revenues control, budget elaboration and control), cash management, billing and revenue collection, payrolls;
- The Joint Affairs directorate is in charge of Human Resources (HR) management, Legal affairs, Procurement, and IT management.

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

Geographical organisation: The supply area of BMLWE is divided into 21 offices/branches, each one has an office. Each office carries out:

- Customer management activities, within the "Subscribers division":
  - The front office (new contracts, information updates);
  - The cashiers and cash collectors (revenue collection at the office or door-to-door, domestic water meters reading);
- Distribution control activities (control on-the-field of the information provided by new subscribers before the installation of the connection);
- O&M team for the distribution network (water connection installation & small repairs), within the "Works division";
- O&M team for the stations and transmission networks, which reports to the Technical department.

Some branches include a warehouse and laboratories.

Additionally, it is essential to emphasise that several positions within this organisation remain vacant to date. In 2020, 68% of the positions were vacant[4], and it is expected to get worse by the next few years, as BMLWE is not authorised to recruit new employees. However, it is important to note that a technical assistance, funded by the Ministry of Energy and Water and the AFD, is currently working on rationalising BMLWE's organisation, as it is considered to be oversized regarding its real needs.

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[4] Based on "BMLWE Achievements and Future Plans"- DG Jean Gebran, May 2021

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:

Table 1: Business process repartition

Business process	BMLWE's units
IT management	IT department (Joint affairs directorate) *(HQ)*
Operations & Maintenance	Stations departments (Technical directorate) *(branches and sites)*
	Works divisions (Distribution directorate) *(branches and sites)*
	Laboratory (Technical directorate) *(sites)*
Customer management	Finance directorate (Billing & revenue collection department) *(HQ and branches)*
	Subscribers division (Distribution directorate) *(branches)*
	Distribution control division (Distribution directorate) *(branches)*
Financial & accounting	Import control department (Finance directorate) *(HQ)*
	Finance department (Finance directorate) *(HQ)*
	Accounting department (Finance directorate) *(HQ)*
	Payroll department (Finance directorate) *(HQ)*
Administrative, legal, HR (incl. HSE/QMS)	Human resources department (Joint affairs directorate)
	Legal affairs & Transactions (Joint affairs directorate)
	Warehouse department (Distribution directorate) *(HQ, branches and sites)*
Technical	Project department (Technical directorate)

*HQ=Headquarters

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

Table 2: Digital scale

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	ex. integrated ERP	Digitalisation from field to dashboard
0%	20%	40%	60%	80%	100%

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 next chapter on digital maturity.

2.1. DIAGNOSTIC OF THE IT MANAGEMENT PROCESS

2.1.1. MANDATE

The IT department is responsible for:

- Maintenance of all desktops, servers, storage and network equipments;
- Administration of the network infrastructure;
- Administration and maintenance of the digital tools databases;
- Daily backup of the databases, systems, and network equipment;
- User support;
- Project management of IT and Operational Technology (OT) projects (eg SCADA).

2.1.2. ORGANISATION

The IT department is part of the Joint Affairs directorate. It is organised as shown below:
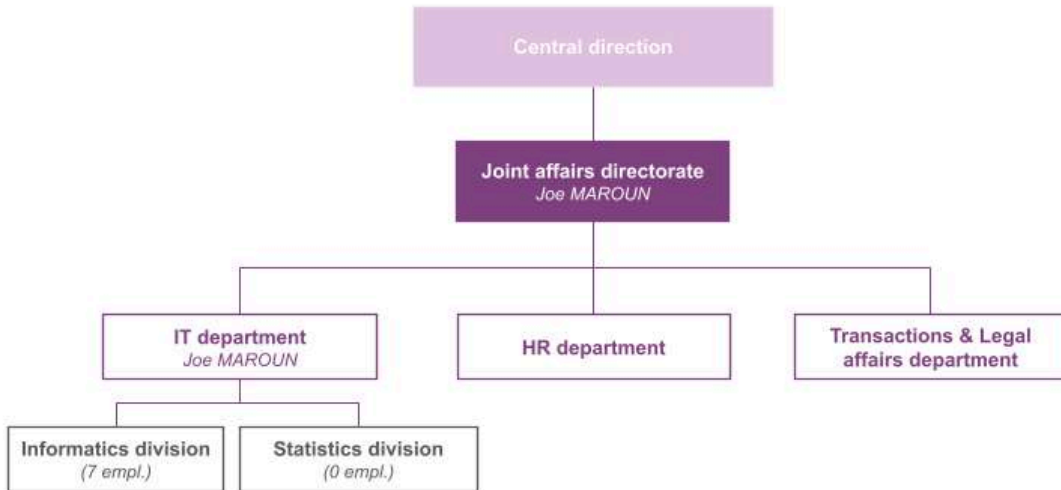
Figure 4: Organisational chart of the IT department

The team is composed of a:

- An IT manager coordinating the IT team;

- 3 senior engineers and 3 junior engineers dealing with system, database administration and support;

- 1 DAI Global LLC external staff (part time) for ERP management (business evolution, user support, correction of bugs).

All IT staff within BMLWE are contract workers (called "daily workers") with no advanced skills.

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 table 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	N/A
Users	Informatics and Statistics department
Uses and Shortcomings	
There is no IT strategy nor digital roadmap;	

- BMLWE has IT policies;
- Governance relies on the strong leadership of the Joint affairs director.

% of Digitalisation of the process	20%
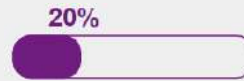
Project management	
Tool	Microsoft office
Users	Informatics and Statistics department

Uses and Shortcomings

- The IT team used to manage several IT projects (SCADA, call centre, infrastructure improvement) but there is no project in IT since 2018;
- ERP improvement projects are done by DAI Global LLC financed by USAID without being directly followed by the IT team, new features are requested via a paper form;
- Ongoing or futures ERP key projects are :
  - Replacement of the inhouse billing and collection software by a dedicated ERP module (in 2024 budget);
  - Digitalisation of BMLWE documents (refer to "Data Management, documentation and SOPs" process below);
  - New procurement system compatible with the procurement law 244/2022, addressing also communication with vendors and suppliers.

% of Digitalisation of the process	20%
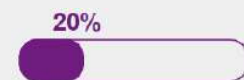
Network and security Management	
Tool	Sophos firewall tools, Barracuda cybersecurity solution
Users	Informatics and Statistics department / security subcontractors

Uses and Shortcomings

- The infrastructure is secured via a robust firewall/VPN configuration but it requires regular hardware and software updates as well as continuous support by a dedicated company specialised in infrastructure security.
- The firewall system is not up to date but will be replaced soon by USAID.
- Security tasks (firewall configuration, update/patch management, etc..) are handled via 2 contracts to security expert companies.
- BMLWE uses an active directory to manage users access an prevent unauthorised access,
- Barracuda cybersecurity solution is used to protect BMLWE against malware, phishing and

ransomware.

- There is no antivirus software installed on servers or computers.

- Active directory is used to manage access to the ERP.

- Only a limited number of employees have Internet access on their work computers (managers and engineers).

- The Internet speed is currently sufficient (10 MB), but may become limiting if all employees were to have access to it.

- Intranet speed in the head office in Beirut is 16 MB and either 3 or 5 MB between the 23 branches and the head office. It is currently sufficient as it is only used for ERP connection and few internet connections but would not be enough if a cloud based approach is implemented.

- The intranet connections between the head office are achieved via two links; the primary link is Microwave provided by Connect and Leased Line is secondary connection provided by Ogero. The VPN connections are protected by unpredictable behaviour firewalls.

% of Digitalisation of the process	60%

Hardware and Software Management - Licence Management	
Tool	N/A
Users	Informatics and Statistics department

Uses and Shortcomings

Hardware and Software Management
- An access secured (access control, CCTV), air conditioned , fire protected server room in the Beirut office hosts all the servers of BMLWE infrastructure.

- Infrastructure is composed of
    - Servers (30 VM) for:
        - In house Billing System & CRM;
        - ERP Microsoft Navision;
        - GIS Geographical Information System;
        - SCADA Supervisory control and data acquisition;
        - Smart meter server;
        - Call centre (Cisco Business Edition)
        - Website.
    →The servers have ageing hardware, replacement should be considered in the coming years,
    - 350 computers *(180 connected to the system (ERP, Billing system, etc.) and 170 which are standalone desktop computers)*:
        - 70 PC in Beirut;
        - 10PCs in large branches;
        - 5PC in small branches.

→During the visit in the Jbeil branch, it has been noted that the desktops computers are not always repaired, preventing staff from performing their tasks(e.g. report on production from O&M staff). The working desktops are very slow due to obsolete hardware.

- The redundant 20KVA UPS and 200 KVA power generator provides backup power for all the infrastructure of the Beirut office.
- A 4 hours call to repair contract, covers the server and network hardware, support for desktop and printers is handled by BMLWE IT team.
- The overall cost of the maintenance is 250.000 USD per year.

Licences management:
- SEURECA has not found a list that allows tracking of existing hardware and software and licences list, a assessment of the ICT infrastructure was made in 2021 by UNICEF that could be used to create/update the asset list.
- The ERP licence is paid by USAID, the other licences for computers and software do not appear to be authorised licences, the budget to pay all licences fees for 250 users was estimated at 600.000 USD by IT.

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.

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

% of Digitalisation of the process	30%

Data Management, documentation and SOPs

Tool	N/A
Users	All BMLWE staff

Uses and Shortcomings
- There is no dedicated data governance.
- Data is either stored on the personal computer or in a shared folder on the servers.
- BMLWE does not have documentation for the software beside the one for the customised ERP. But this one has not been updated since 2018.
- There is no tool to manage and store BMLWE documents so a tender has been initiated to digitalise all the paper documents and store them in an ERP.There are IT Procedures in place that are stored on the server.

% of Digitalisation of the process	40%

User support	
Tool	Phone, email, TeamViewer/Anydesk
Users	Informatics and Statistics department

Uses and Shortcomings

- The user with an issue can contact the IT team by phone or by email;
- The IT team tracks the status of the request on an excel sheet. The IT team can take control of the computer remotely using Teamviewer, Anydesk or remote desktop to solve the issue.) If necessary, the team can go to the corresponding site as an escalation process;

  The fact that the IT team is centralised makes difficult any task requiring a physical action on the hardware in the branches and impacts on the resolution time;
- There are 350 users of tools within BMLWE;
- The BMLWE IT team doesn't handle support for the ERP, it is done by DAI staff but BMLWE staff are being trained to handle level 1 support.

% of Digitalisation of the process	10%

Vendor and supplier management	
Tool	N/A
Users	Informatics and Statistics department

Uses and Shortcomings

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

% of Digitalisation of the process	0%

Disaster Recovery and Business Continuity	
Tool	Commvault Data Backup and Recovery
Users	Informatics and Statistics department

Uses and Shortcomings

- Data is backed to local backup servers and to external USB devices using Commvault solution software.
- Backup is made daily on local storage and weekly on external storage.
- Unicef assessment of the ICT infrastructure highlighted the lack of a business continuity program/plan which is still relevant now.

% of Digitalisation of the process*	70%

Training and Skill Development (on digitals tools)	
Tool	N/A
Users	All BMLWE staff

Uses and Shortcomings

- IT Staff: the only current training identified is the one on the ERP to be able to do the support level 1 in house and not depend on DAI, Junior staff are mentored by senior staff for

skill development.

- BMLWE staff: no dedicated training on software for the last 5 years.
- No e-training available.

% of Digitalisation of the process	0%
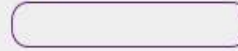
2.1.4. SUMMARY

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.

Information Technology Processes

Governance and strategic planning	20%
Project Management	20%
Network and security Management	60%
Hardware and Software Management	30%
Data Management, documentation and SOPs	40%
User support	10%
Vendor and supplier management	0%
Disaster Recovery and Business Continuity	70%
Training and Skill Development (on digitals tools)	0%
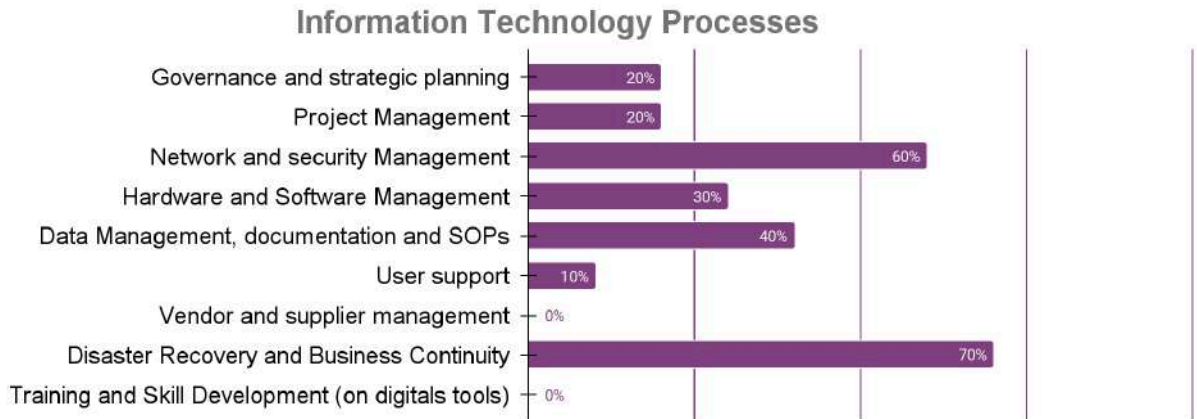
Figure 5: *Digitalisation overview of IT subprocesses*

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
Quality and **protected against cyber attack** network infrastructure; **State of the art** server room; **Knowledge** and **leadership** of the Joint affairs director; **Specialised development (ERP) and maintenance** outsourced; in the context where BMLWE can't hire skilled staff, it is the most relevant approach.	**Lack of maintenance or replacement of desktop** leading to degraded operation conditions for BMLWE staff; **Lack** of **cybersecurity audit**; **Lack** of **IT master plan**; **Aged** server **hardware;** - IT operations are **not formalised in SOP;** **No apparent asset management** (costed hardware and software asset list);

	● **Limited IT skills** within the IT team.

Opportunities	Threats
● **Strong technical culture** from years of operations of an advanced water establishment; ● **Support of USAID for ERP** related projects and improvements.	● **Centralization of IT service** making the user support **difficult**; ● Only ERP licence **fees are paid**.

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.

Category	Recommendations	Priority
Organisation	Perform cybersecurity audit	1
	Create a IT master plan	1
	Update ERP documentation (no update since 2018)	1
Skills	Improve tool usage by sharing with the end user all the available documentation (mainly ERP), etc.	2
	Organise regular Cybersecurity awareness training for the employees	1
Tools	Fix, change existing or provide new computers for BMLWE staff (especially O&M) to perform and be efficient in their activities	1
	Organise the helpdesk by creating a module in the ERP to track the requests	2
	Pay for the licence fees with the financial support from donors	2
Processes	Create of a list to track the existing software, with the version, number of licence, usernames and rights	1
	Create of a list to track the existing hardware, with the date of installation, last update, and usernames	1

	To streamline the management of IT assets, integrate them into an asset management module within the ERP system	2
	Create a business continuity program Review and update SOPs for all processes	1

Table 3: List of IT management business process recommendations

2.2. Diagnostic of the Operations & Maintenance business process

2.2.1. Mandate

BMLWE O&M activities are divided among two directorates.

- In the Distribution directorate, the Works divisions of each branch are in charge of:
    - installation of new connections,
    - maintenance of the connections,
    - small repairs on distribution networks,
    - management of warehouses in local branches and centralised warehouse in Beirut.
- In the Technical directorate, the O&M and station divisions of each branch are in charge of:
    - operations of the treatment station and production monitoring,
    - operation of the transmission network, pumping station and reservoirs,
    - basic leaks detection,
    - water quality monitoring (laboratories).

Leak repairs and maintenance interventions are outsourced.

2.2.2. Organisation

Those departments report to the Director general. There are organised as shown below:
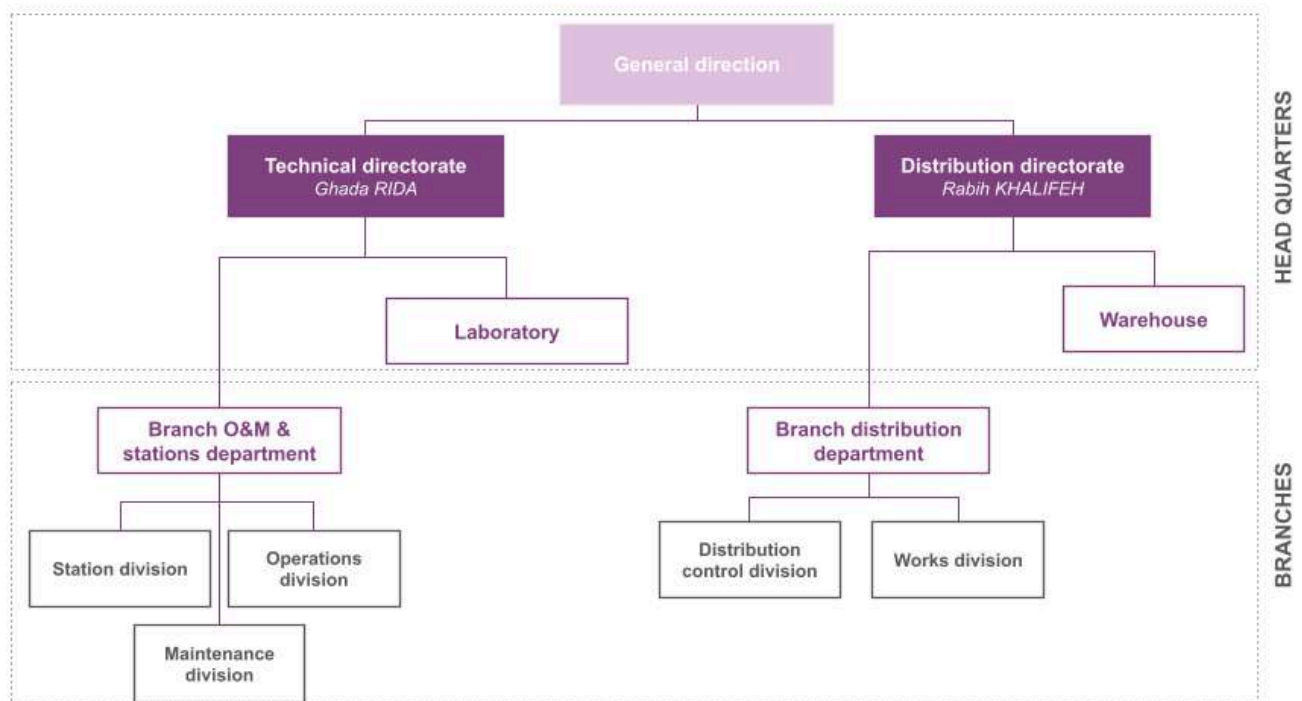
Figure 6: *Organisational chart of the departments involved in Operations & Maintenance*

There is no centralised direction for all Operations & Maintenance activities, which would enable having coordinated strategy and a consolidated volume monitoring.

2.2.3. ASSESSMENT OF SUB-PROCESSES DIGITALISATION STATUS

Based on the interviews and on-the-job observations, an assessment of the digital tools used in each sub-processes was carried-out, as presented in the table below, in order to identify the status of digitalisation of each one and the main shortcomings in the current situation.
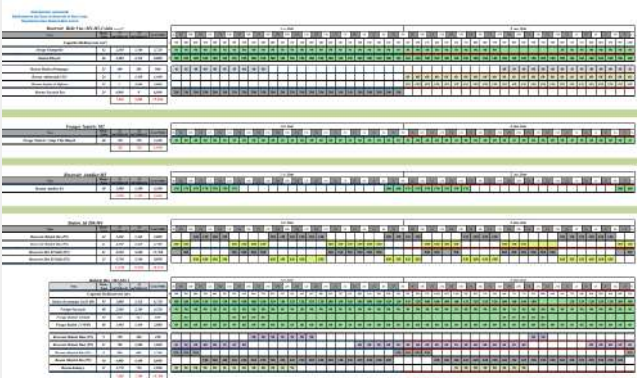
Manage work tasks - Above Ground Assets / Water Treatment Plant	
Tool	None
Users	-

Uses and Shortcomings

Water distribution programs are generated in the Beirut office and transmitted to the production sites. When the main SCADA was in operation, water distribution programs were enforced from the SCADA. Production used to be monitored closely with weekly reports sent from the site to Beirut in electronic version. But now, due to lack of staff and computers, it is not done anymore and production volumes are not tracked anymore. It is a major issue as it prevents correct resources management and could lead to some over usage of particular resources (groundwater).

Figure 7: Example of a water distribution program

On production sites, the tasks to be carried out are communicated exclusively by telephone or whatsapp. The team leader collects these tasks and dispatches them on a daily basis according to human and material requirements. There is an intervention register on the sites, but the information is not consolidated in a tool.

There is no preventive maintenance. No paper culture for the inspections of the sites, oral communication is generalised.

As there is no intervention monitoring, there is no history kept regarding the assets.

Analysis and water sampling schedules are drawn up on paper (see Laboratory management below).

% of Digitalisation of the process	20%

Manage work tasks - Underground Assets	
Tool	QGIS
Users	GIS expert (Technical Department)

Uses and Shortcomings

Asset management
- The GIS is based on Qgis software with PostGIS DataBase for hosting data. BMLWE migrated 2 years ago from Hexagon GIS to Qgis (2 years ago).
- The GIS database contains approximately 80% of the underground assets in the cities and 50% in rural areas.
- All branches are registered in the GIS, however for some branches there is no information about sectorization of the network.
- Leaks/interventions are not reported in the GIS.
- New connections are registered, using the parcel number and a cadastral layout.
- The update of the GIS is made difficult by:
  - The absence of communication between GIS and other software; data collected are reported manually and consolidated on separate excel sheets resulting in:
    →significant risk of error,
    →significant waste of time to enter data in the GIS database.
  - The absence of procedures to streamline the reporting of information to GIS from other departments (O&M, Customer, etc.),
  - Outdated computer used by the staff for GIS management.
- Although the high level of information set up in GIS, the WE does not take full advantage of it, for instance to carry out an asset management programme, or customers regularisation campaigns.
- There is one GIS expert managing the GIS, who is well-trained and competent.

  Nota: The GIS expert acts also as the lead of the studies team of project department (refer to paragraph 2.7),

Interventions
- Interventions are triggered by complaints following calls to the centralised call centre. Each complaint is routed to the corresponding branch where staff has local access to the CRM software. Once the complaints are received and intervention validated by the branch manager and then the head of Distribution or the head of Station, a dedicated subcontractor performs the work under the supervision of BMLWE staff. If parts are required, the Manage stocks & warehouse process is followed.
- For connections below 30 metres (from the main), the works are performed by the works division staff. For longer connections, it is performed by a subcontractor.
- The process of new connection creation and intervention is a mix of oral communication (with subcontractors for example) and paper forms (written proof that the connection works have been completed). There is no additional monitoring and control of the work performed.
- The O&M team doesn't have direct access to GIS. When they need information on the underground assets, they request to the GIS expert an extract that is then sent to them via whatsapp.

% of Digitalisation of the process	
	20% for Work tasks management
	50% for Underground assets management

Alarm Management	
Tool	SCADA
Users	O&M staff

Uses and Shortcomings

- The SCADA supervising the water network is currently out of service.
- Other local SCADA exist for the supervision and control of the large treatment facility (drinking and waste water).

For more details, see below part 2.3

% of Digitalisation of the process	
	0%

Manage stocks & warehouse	
Tool	ERP Dynamics NAV
Users	Distribution department, Technical department

Uses and Shortcomings

The analysis is based on an example of an on-site warehouse in Jbeil.

Warehouse inventory:
- **The inventories of the warehouses are made on the ERP**, based on regular material inventories made by the warehouse manager and **entered manually in the system** (they have to do it on a yearly basis, but they usually do it at least monthly).
- However the warehouse manager can only access the inventory of its own warehouse, which prevents him from knowing if there is a shortage in the centralised warehouse of Beirut.

Delivery of a spare part:
- The **request for a sparepart is made orally** to the warehouse manager, who enters it in the ERP, checks the availability in the inventory made in the ERP, and prints a form related to the demand. **The validation workflow is then followed on the paper form.**
- When the spare part is delivered to the operator, a **paper receipt** is given to him and then signed by different validators. **The ERP inventory is updated manually by the warehouse manager.**

Purchase of parts to restock the warehouse:
- There is **no automatic alert from the ERP in case of shortage**. Store managers must monitor their inventories, and the quality of their supplies depends on their assiduity.
- The on-site inventories cannot issue purchase orders neither on the ERP nor on paper, they **ask for a replenishment from the branch warehouse. The process is totally paper-based.**
- The **central warehouse can make written purchase requests**. (See purchase process in the Admin, legal and HR chapter)
- The coordination of delivery of the parts from central to local warehouse are managed by phone.

The **warehouse management procedures seem well-implemented**. The ERP seems properly used however the digitalisation of the process keeps being limited by the strong paper-based culture (validation workflows and communication between sites and department). The logistical coordination remains mostly on the phone.
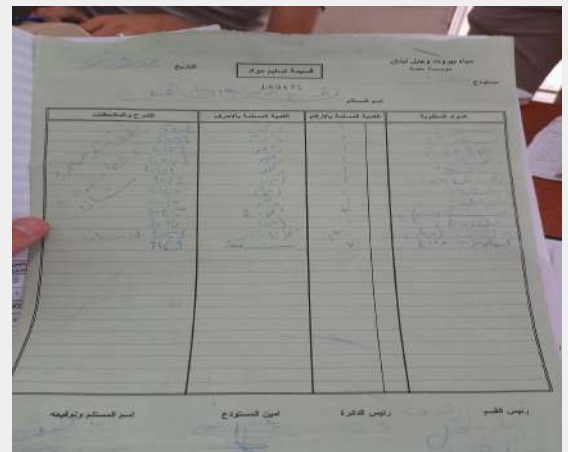
Figure 8: Illustration of a request to the warehouse

% of Digitalisation of the process	60%
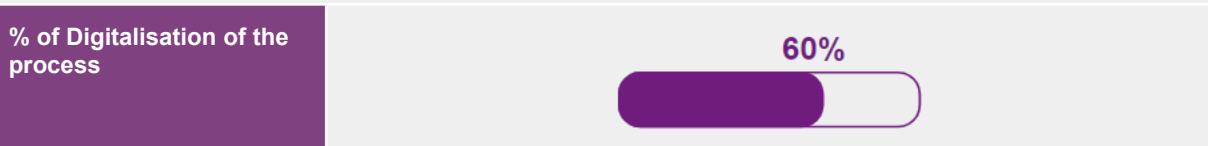
Monitor energy consumption	
Tool	-
Users	-

Uses and Shortcomings

- Energy consumption is **monitored on paper**, thanks to regular on-the-field meters reading. The readings are transmitted by **whatsapp**.
  Since the crisis, as procedures are weakened by the lack of staff, **the regularity and quality of consumption monitoring varies from one branch to another, depending on the professionalism of the operations managers**.

- In Jbeil, the **information used to be consolidated manually on word/excel reports**, sent to the Headquarters. It is not possible anymore as the computer used is out of order and has not been repaired or changed. Paper version of the consolidation is maintained. However, it's impossible to assert that this work is done in all branches. In any case, **there is no dedicated software used to register and consolidate the information.**

→ **Due to the lack of systematic data collection and reporting procedures, it is impossible for BMLWE to really monitor its electricity consumption,** which triggers several issues:

- **It is impossible to double check the invoices sent by the electricity providers.,** which is not a key issue as since the financial crisis, electricity bills are not being honoured.
- It makes it impossible to optimise energy consumption.
- It makes it impossible to detect anomalies or deviations, which is key to identifying faulty equipment or installations.

% of Digitalisation of the process	20%
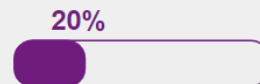
Water quality Monitoring / Laboratory information management system	
Tool	Excel
Users	Laboratories (Technical Department)

Uses and Shortcomings

In BMLWE, there are various laboratories (but only 3 operational in Dbayeh, Baadaran and Ghadir). Daily tests are carried out.

- Regular reports (weekly reports) from each lab are be sent to the Head of Technical department.
- Only emergencies are reported during the day, usually via whatsapp.
- The written daily sheet is considered as the "original" and is archived and used in case of problem. There is no software used to register and consolidate the water quality data.
- The analyses performed are neither reported on the GIS, nor on SCADA.

→ **This makes it difficult to spot deviations and correct them, before reaching a problematic situation.**

There is no digital backup of water quality data, which is necessary to be accountable to external stakeholders, and key in the event of any legal issues arising in this respect.

% of Digitalisation of the process	40%

Monitor network performance	
Tool	-
Users	Technical Directorate

Uses and Shortcomings

As network SCADA is not functioning anymore:

- The **data of water production and consumption are monitored thanks to water meter readings**, whose regularity depends on the Operation managers since there are no proper procedures to streamline the process, and **reported manually**.

- In the Jbeil branch, the information was consolidated on excel reports, used to detect anomalies and possible leakages and sent to the headquarters by email. But it is not possible anymore as the computer used is out of order and has not been repaired or changed. Paper version of the consolidation is maintained. . However, it's impossible to assert that this work is done in all branches. In any case, **there is no dedicated software used to register, consolidate the information, and analyse the network performance**.

- There are no systematic reporting procedures for leaks and repairs information to the department in charge of the GIS.

- It has to be noted that there were pilot projects in Ashrafieh and Al Matn to implement district meters and customer meters in order to evaluate and reduce the NRW. But these projects need to be scaled up to have a significant impact on the network performance.

→ **Due to the lack of systematic data collection and reporting procedures, it is impossible for BMLWE to really monitor its network performance**, which triggers several issues:
- BMLWE 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.
- It does not appear that BMLWE has sufficient information to be accountable to external stakeholders (customers, ministries, donors).

Figure 9: *Illustration of manual reporting from meter reading*

Figure 10: *Illustration of volume monitoring excel report*

% of Digitalisation of the process	40%

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.

Operation, Maintenance and Project Management

Subprocess	Percentage
Manage work tasks - Above Ground Assets / Water Treatment Plant	20%
Manage work tasks - Underground Assets	50%
Alarm Management	0%
Manage stocks & warehouse	60%
Monitor Energy consumption	20%
Water quality Monitoring / Laboratory information management system	40%
Monitor network performance	40%
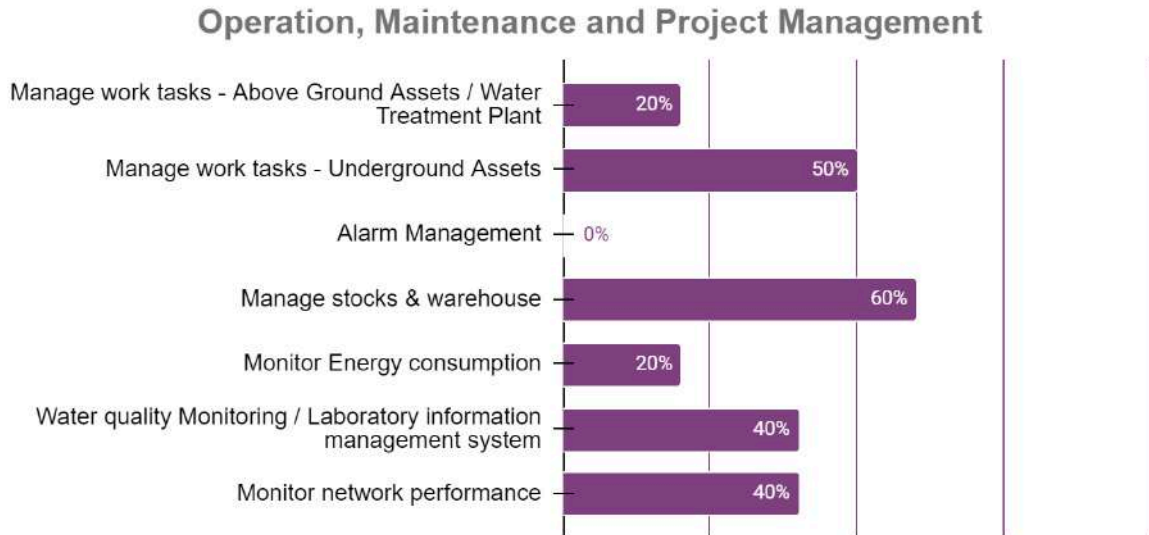
Figure 11: Digitalisation overview of O&M subprocesses

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
Competent staff; **Motivated staff** despite the difficult context (noticed in Jbeil branch); **Culture of water distribution management** according to the season, resources available, via water distribution programs sent to each branch and report of real water produced.	**Lack of on-the-field data collection and reporting procedures**; **Lack of software to consolidate field information**; **Lack of computers** to perform to perform reporting tasks **Lack of SCADA system** to monitor and control network and production sites; **Lack of procedures to streamline the sharing of operational data** between department; **Lack of procedures and software for the planification of interventions**;

	● **Strong paper culture**;
	● Maintenance works were mainly made by subcontractors but contracts **financing by donors have recently been cancelled**.
Opportunities	**Threats**

● **Existing SCADA** which could be restarted if design improvements are performed (refer to SCADA focus section);
● **Good quality GIS** that could be used to improve Underground asset management.
	● **Economic crisis in Lebanon**, which limits the budget available for BMLWE leading to difficulties to:
	  ○ keep experience staff and BMLWE culture of water; distribution management
	  ○ maintain assets in good conditions.

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.

Category	Recommendations	Priority
Organisation	Ensure that energy consumption and production volumes are collected on site and send to Beirut office for tracking purpose,	1
Skills	Training on O&M monitoring excel template and procedures	1
Tools	Fix, change existing or provide new computers for O&M staff in order to track energy consumption and production numbers	1
	Implement a CMMS module within the ERP (as it has been done in SLWE)	2
	Implement a mobile application to register the operation related to the assets.	2
Processes	Implement procedures and provide electronic files format for on-the-field reporting to streamline and impose monitoring best practices (asset inventory and logs, works performed,volume produced, etc..)	1

Table 4: List of O&M business process recommendations

2.3. FOCUS ON SCADA

In parallel to the digital assessment of BMLWE, a focus on the existing SCADA and future projects 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.

2.3.1. INTRODUCTION AND MANDATE

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:
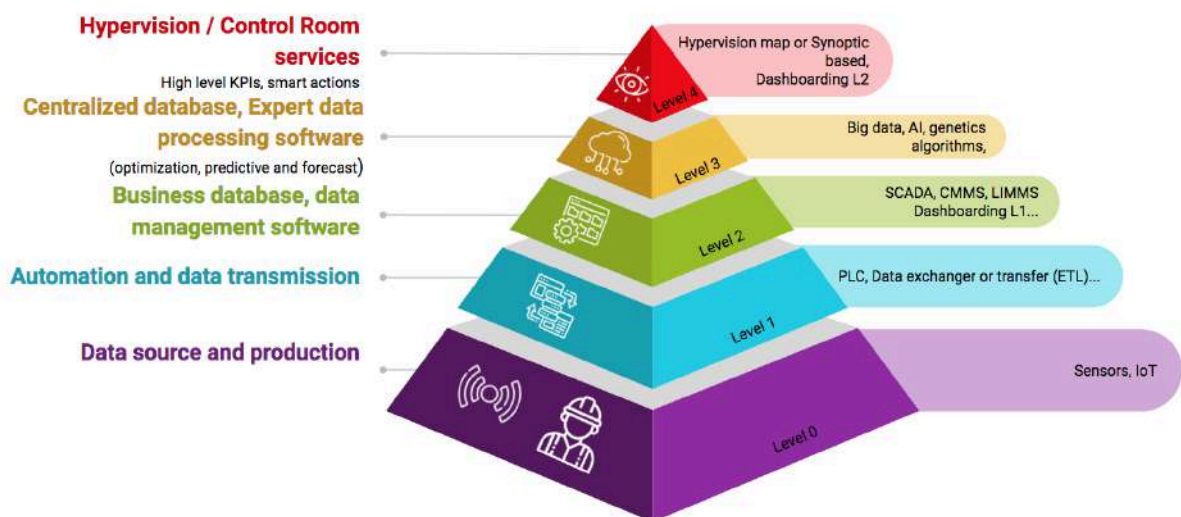
Figure 12: Computer Integrated Manufacturing (CIM) Approach (ISA-95)

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".

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.
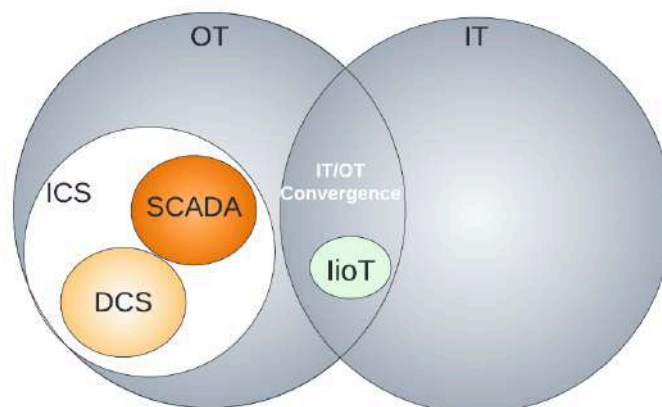
FIGURE 13: SCADA, ICS, OT, IT

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.

2.3.2. CONTEXT AND ORGANISATION OF BMLWE REGARDING SCADA

The installations of BMLWE are divided into 2 parts. On one side, some sites were integrated to a central Supervision system, which will be referred to as "Main SCADA" in the rest of the document. This Main SCADA represented ~20% on the establishment's sites, and was deactivated due to energy and economic issues. On the other side, stations have local control equipment (PLCs, RTUs, relay boards, etc.) with no outside communications.

2.3.2.1. TEAM ORGANISATION AND SKILLS

The SCADA Team is part of the Technical Directorate as it is mainly related to operations. When the Main SCADA was in operation, the team was composed of 4 members:

- One SCADA Operation Manager, who was in charge of overall management and deployment of SCADA equipment ;
- Three SCADA operators, in charge of monitoring and controlling the existing automated installations.

Despite the shutdown of central control for the establishment, the members of the team are still part of the establishment. The main process of the team was to respond in case of anomaly detected through the Supervision and to follow the water distribution program. The following chart is available in the Central control room.
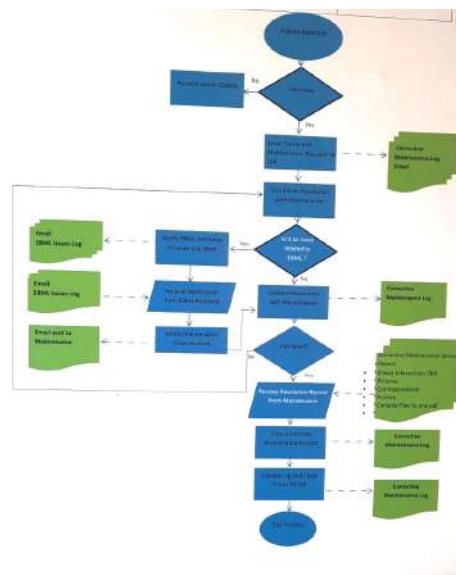
Figure 14 : Corrective Maintenance Procedure Flowchart

2.3.2.2. SCADA MAINTENANCE

The SCADA used to be maintained by the main integrator of BMLWE installations, EMCO Group, as part of an overall design and maintenance contract. This maintenance contract ended and was not reconducted. As this contract only covered the SCADA that were designed by EMCO (and not the other plant SCADA), so the termination of this contract has no direct impact on operation of the pumps.

It has to be noted that there is no automation knowledge within BMLWE, preventing any repair of the current systems in operation (plant SCADA).

2.3.3. GREATER BEIRUT SCADA

2.3.3.1. IMPLEMENTATION

BMLWE used to have a SCADA able to supervise and control around 100 sites out of a total of 500 sites. The tender was initiated in 2015 and the implementation took place in 2016. The implementation was split into 4 phases. The breakdown of the number of PLCs among the different phases is shown below.

Phases	Number of associated PLCs and RTUs on office installations
P1	37
P2	18
P3	18
P4	26

Table 5 : Breakdown of the number of PLCs on Greater Beirut

The SCADA system has been working for 4 years before site control cabinets and central supervision had to be progressively deactivated due to lack of electricity. Indeed, the situation of the country did not allow for a steady energy supply for the headquarters of BMLWE and water production and distribution infrastructures. This lack of energy also affected the communication network and the overall availability of water to follow the pumping strategies in place and ensure continuous supply.

Therefore, it has been decided to shut down the system and switch the local cabinets to manual control mode. Therefore the operators on site have to follow the water distribution programs (refer to "Manage work tasks - Above Ground Assets / Water Treatment Plant" process in the previous O&M chapter) and adapt the controls manually.

We have reviewed the tender specifications provided and have the following comments :

- The overall package is very comprehensive in contractual and technical terms,
- The scope of the project extends beyond the SCADA with implementation of instrumentation and electrical cabinet (Motor Control Centers),
- Main technical concepts are relevant for SCADA dedicated to water operations (operating mode, redundancy, etc..) but the technical specification lacks to specify :
  - Performances expected by the system,
  - Number of signals (I/O) per type of equipment (instrument, motor, valve, etc..),
  - Logic to be implemented in the each PLC to make the system automatic and not only relying on SCADA operator,
  - Alternative power supply for control equipment (etc. solar panel). It has been the principal reason why the SCADA is no longer online in the context of discounted power supply,
  - Data loggers instead of RTU for monitoring only installations (reservoir without pumps, flowmeter making the system and possible smart projects more difficult and more expansive to integer within the SCADA,
  - Dedicated server room to host servers; this was finally achieved during implementation,
  - Backup control room and datacenter in case of issue in the Berut office,,
  - Design documents to be provided throughout the project and especially "As-built" documentation.

- While the SCADA specified was of high technical level in 2015, it does not meet the modern SCADA characteristics such as virtualization of servers, cybersecurity at each level including the protection of the exchanges with external applications via a DMZ

The following paragraphs present what has been designed to meet the tender requirements. Unfortunately we did not have access to the "As-built" documents so our recommendations are limited to the tender specifications and information collected on site.

2.3.3.2. CONTROL STRATEGY

A control strategy was defined by the establishment on this Main SCADA, splitting the responsibility as follow:

- Central control room: Overall supervision of installation status and command of pumps according to the pumping planning ;
- Local control cabinets: Communication with central control room, control of equipment and local safety functions ;

This organisation required the several SCADA operators to be present in the control room all the time, to communicate with operators, send commands according to distribution needs and status of equipment (e.g. start a pump in case of failure of another). There was no automatic function programmed in the PLC or RTU beside process safety protection (e.g. overflow level for tanks, pumps physical status). Therefore local control mode was not compatible with this regional control strategy.

2.3.3.3. EQUIPMENT USED

The control room was located in the main office of BMLWE (Badaro building). The room is equipped with 2 workstations for SCADA operators, 1 Engineer workstation, and three large wallscreens for the display of some synoptics. A secondary Central SCADA Center was expected during the tender phase but was not implemented.
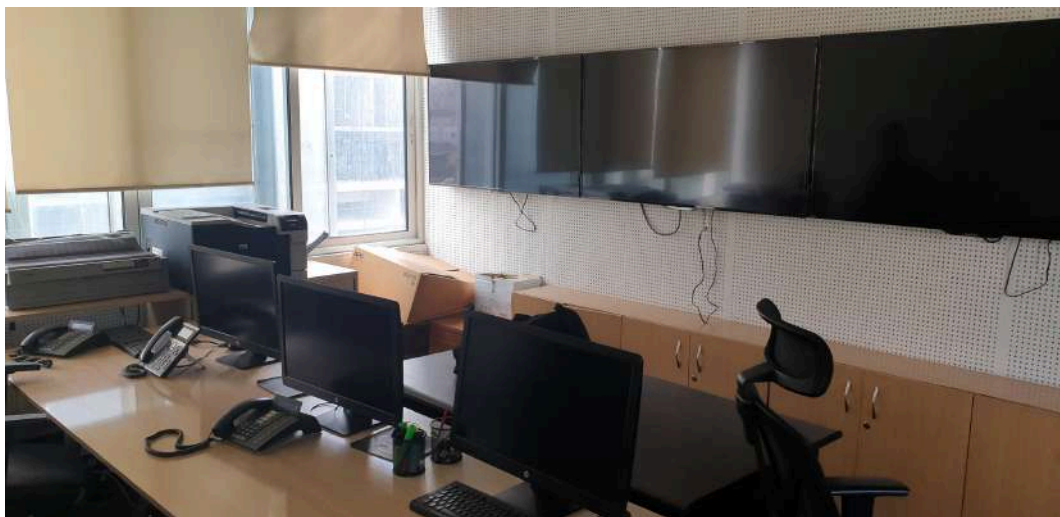
Figure 15: Main SCADA control room

The supervision is hosted in 2 servers (ProLiant DL380 G9) in the server room, located on another level of the building. A permanent licence of Clear SCADAby Schneider allows the control room to pilot more than 100 sites (PLC or RTU) equipped with mainly Schneider controllers.

The communications between distant sites and the control room are covered by 4G GSM or Wimax. These 2 communication media induce the use of antennas placed on outside walls or in control cabinets.

The controllers used on sites are mainly Schneider PLCs and RTUs. RTUs are only used on distant sites that do not have power equipment (e.g. pumps) such as reservoirs.

The following views were available in the supervision before the shut down of SCADA operations.
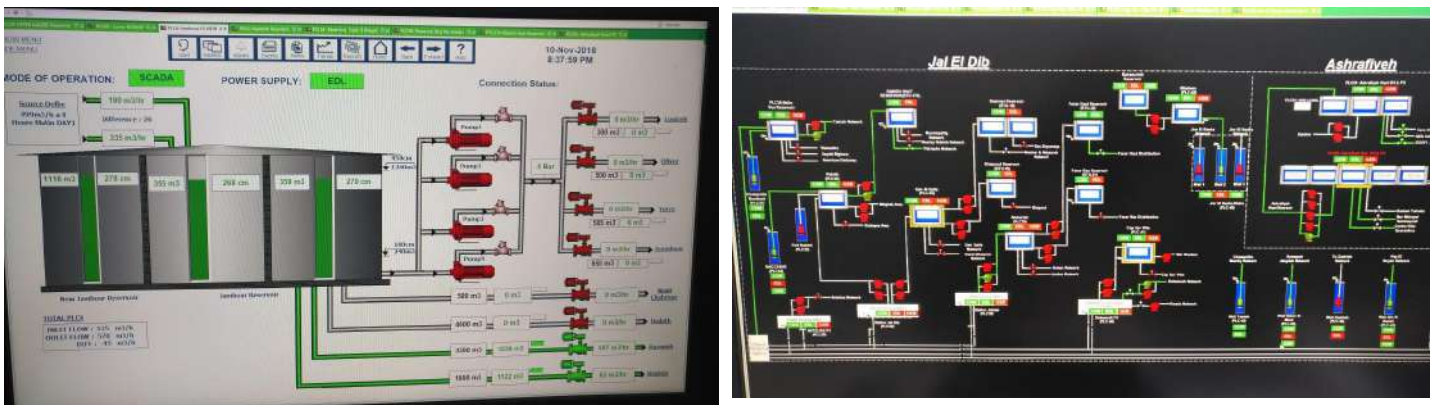
Figure 16 : Example of synoptics that were available in the supervision

The available views show a good arrangement of the synoptic with data and functionalities explicit enough for the operator. The available features are:

- Synoptic views;
- Alarm generation and logs;
- Event logs;
- Notes;
- Trends;
- Reports.

We were not able to check all the views and functionalities, and their consistency with the specifications.

Jal El Dib PS architecture details

Jal El Dib Pumping Station, a site part of phase 1 was visited. The site is in function but there is no communication to a central supervision. The control cabinet is composed mainly of:

- A Schneider PLC (Modicon M340 series) ;
- An HMI on the cabinet's front panel (Schneider Magelis) ;
- An industrial 4G/ADSL router (Case Comms 6402 series);
- A Wifi modem;
- A power meter (Schneider) ;
- Other control elements (switch, relays, etc.).
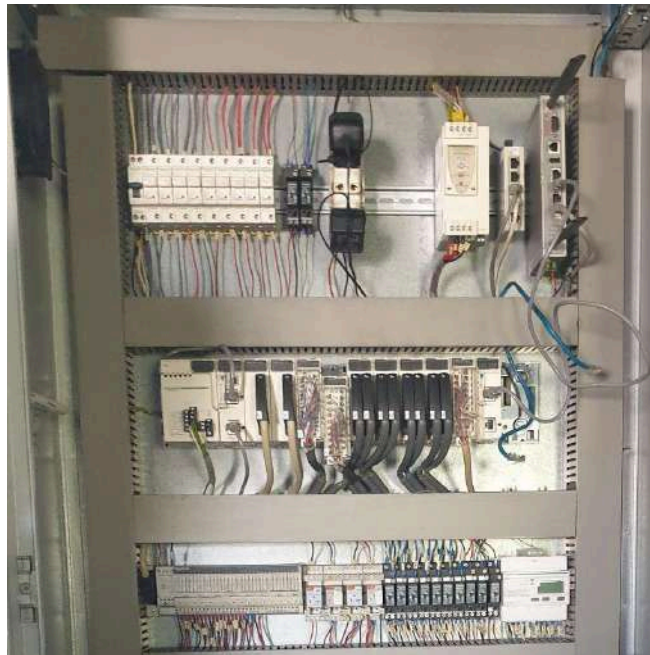
Figure 17 : Observed control cabinet on Jal El Dib Pumping Station
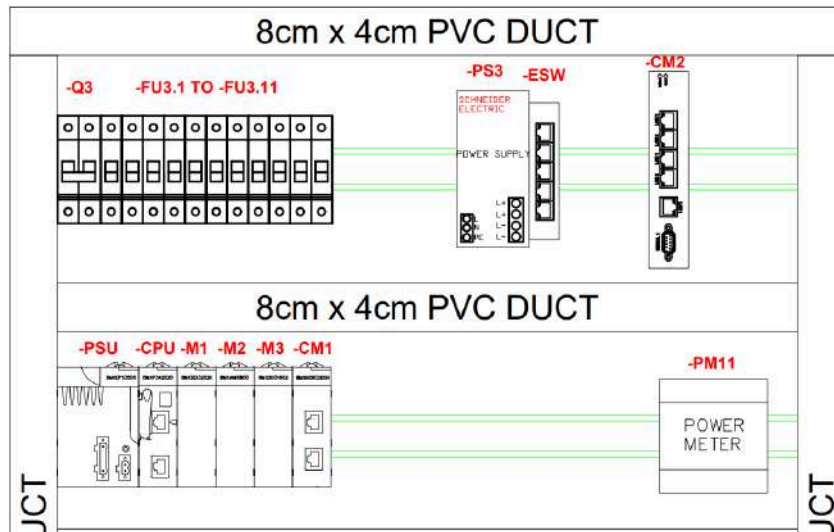
Figure 18 : Expected Cabinet layout

The HMI on the front panel was switched off so there is no way to visualise real time physical status while doing on-site operations. The documentation that is supposed to be in the cabinet could not be found;

Without the SCADA overall architecture drawings available, it is not possible to verify if the network configuration implemented is correct. But we have identified coexisting networks which might pose cybersecurity issues:

- The industrial router seems to be under-used;
- A Wi-fi modem seems to be added as a convenience solution for local use; the purpose of this modem has not been identified.

Indeed, the industrial router permits dual network for redundancy and local Wifi. The router also has embedded security features (firewalls). We recommend to re-evaluate the design, and removing the added Wifi modem if it is not necessary.

Figure 19 : Added Wifi modem for local supervision

Nota: It is expected that some controllers on-site might be missing on site now. Therefore, the supervision cannot be brought back into operation by only providing energy to controllers. This task will require a thorough assessment of all existing controllers to know their availability and condition.

DIAGNOSTIC UPDATE

A complex system, as the Greater Beirut SCADA, requires well established procedures and properly trained staff. The O&M Manual is the reference for all SCADA operators, on site and at the control room. It has to be transferred as part of the As-built documents and in case of major update of the SCADA system.

Seureca reviewed the content of the O&M Manual of Greater Beirut SCADA system. **The overall quality of the content is good,** with details on some O&M procedures. However **the manual is missing some key elements to support the SCADA team**. In particular, the **operations related to the control room are not described accurately**. The following missing elements have been identified:

- General system description;
- Main controls available;

- General navigation rules in the supervision;
- Hierarchy among different mimics and other screens;
- Principle of main screens (mimics, events, communication screens, etc);
- User authorisations;
- Operating modes;
- On site HMI usage;
- Maintenance Master log;
- The general corrective maintenance procedure (Figure 13) can be added to the document to support the "Logistic" part;
- Schedule elements (preventive maintenance).

O&M SCADA Manual extract

Recommandation :

Seureca recommends updating the O&M Manual as part of the rehabilitation of the SCADA of Greater Beirut, by integrating the above elements as much as possible.

2.3.4. ASHRAFIEH PRIORITY WORKS PROJECT

Additionally to the phased implementation of the Greater Beirut Main SCADA, some other projects were conducted to implement or rehabilitate local SCADA.

This project, is part of an AFD supported initiative named "PRIORITY WORKS ON BEIRUT WATER SUPPLY SYSTEM" was initiated. It consists in the creation or rehabilitation of part of the network and facilities of Ashrafieh. Among the different packages of the initiative, the third package relates to three local SCADA systems and their integration to the central supervision. The project started in 2022 and a tender SCADA requirements document was produced recently.

We have received and reviewed the general requirements of this package ("VOLUME 2 – SECTION VII-1.2 - TECHNICAL SPECIFICATIONS"). While the document addresses most of the required items

of a SCADA system, it lacks to specify several subjects that may be covered by a particular specification (no received at this stage) :

- Communication with the Greater Beirut SCADA;
- Contains, characteristics of control panels (eg equipment such UPS, protection, arrangement);
- Additional feature of a Modern SCADA system such as virtualization of server, on duty systems, record feature;
- Cybersecurity requirements;
- Backup power required in the context of Lebanon (solar panels, genset, etc..);
- Inputs and outputs per type of equipments and instruments;
- Control room general characteristics (furniture, wall screen, etc..);
- Programming requirements;
- Approved vendors list.

This specification is not fully aligned with the Greater Beirut technical specification. Some modifications should be made to ensure coherence between all sites integrated in the future Greater Beirut SCADA.

In a general matter, this document is not self supporting but needs to be completed by particular specifications, detailing to whom (number of equipment, sites, etc..) and how (SCADA architecture, SCADA equipment details) it applies to the context of this Ashrafieh project.

2.3.5. LOCAL SCADA OF TREATMENT PLANTS AND PUMPING STATION

Apart from the sites integrated to the Greater Beirut SCADA, other sites also possess control equipment that have been installed previously and are not consistent in terms of hardware and software with the Greater Beirut Design. Two sites were visited, the pumping station of Jbeil and the WTP of Dbayeh.

Jbeil Pumping Station:

Jbeil pumping station is equipped with a local PLC (Schneider Modicon TSX Micro) in the electrical cabinets controlling the equipment. The PLC is connected to a physical synoptic panel (LED) that is not accessible. As the equipment degraded and no maintenance was available, the automatic features became out of service (due to various equipment malfunctions) and all processes were turned to manual mode.

Figure 20 : Jbeil pumping station PLC showing errors

It was identified that this loss of automatic features results in a significant diminution of productivity. They now have to adapt part of the regular operation and maintenance for it to be feasible manually.

For example, Jbeil station had a programmed backwash every 9 minutes. It is now done manually from the control panel notably less frequently. These modifications induce a less effective productivity of the stations, more tasks, more maintenance, etc.

No backup of the PLC was done when it was operating. This station was part of an NRW project pilot zone so the input and output volumes were monitored. The operators showed a will to rehabilitate this station's SCADA and integrate it to the future central supervision but they do not have the required skills and possess no documentation of the system.

Dbayeh WTP :

The Dbayeh WTP is an old water treatment plant (more than 100 years old) and has been progressively developed since then. The current station is capable of producing 250 km3/day, and an extension of the station will extend the production to 400 km3/day by 2024.

A control room is available for the old station, and was funded by UNICEF and UE.

The main control equipment seen on site were:

- Schneider Easy series: Modicon Easy M200, Harmony Easy HMI;
- Omron: SYSMAC CQM1H.

Several HMI elements are available across the station, mainly digital screen on front panels, physical synoptics with LEDs and individual control desks for filters. The physical synoptics seem to be not functioning, and the filters control desks were switched off, with their circuits wide-opened and accessible.
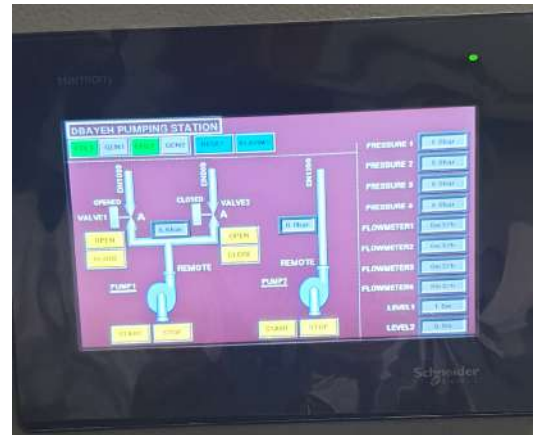
Figure 21 : HMI elements available on Dbayeh WTP

The output treated water of Dbayeh WTP is dispatched to several zones using high capacity pumps. The pumps are driven by VFDs with individual HMIs. The controllers were not seen during the visit.

Figure 22 : Pumping lines and switchgear of Dbayeh WTP

Other stations :

No other stations were visited. We expect the control equipment to be different, as it may be financed partly by different donors and implemented by different contractors.

2.3.6. SMART METERING PROJECTS

2021 Upper Meten

In 2021, USAID financed a project to rehabilitate 10 reservoirs and 29 DMA associated with these installations. The scope of this project mainly addressed measurement equipment (e.g. flowmeters, levels, pressure reduction valves, customer meters, etc). This work included the replacement or fix of SCADA equipment, and the consideration of the integration into the future central supervision.

The goal of the project is to test a NWR reduction approach on some areas. 29 DMAs were first identified, among them 5 DMAs were fully equipped and studied:

- 2 DMAs on Dahr es Saouane distribution network;
- 3 DMA on Beit Chabab distribution network.

The project required setting up 3 main types of equipment :

- PLC on reservoirs: The design of PLCs in the reservoirs was done by the contractor AutomatiX, the only control feature programmed in these PLCs are for motorised valves;
- Bulk meters, pressure sensors and valves on network and reservoirs: the equipment used on reservoirs send their status to the PLC, while network equipment send their data to a cloud platform. The main provider are Krone and ABB;
- Customer smart meters: sensors are walk-by or drive-by. The data is collected manually, and independently to the SCADA, using various equipment and software (SIRT, mobile app, online platform, etc.).

This study led to the proper delineation and evaluation of the DMAs on Dahr es Saouane and Beit Chabab zones. A Water Demand Management Plan was built to progressively integrate other DMAs of Metn to this project. The next steps to move the project forward are:

- Revision of all customer meters;
- Renewal of the licence of the network metering cloud platform;
- Proper commissioning of SCADA equipment (most of the work has been done, except the commissioning).
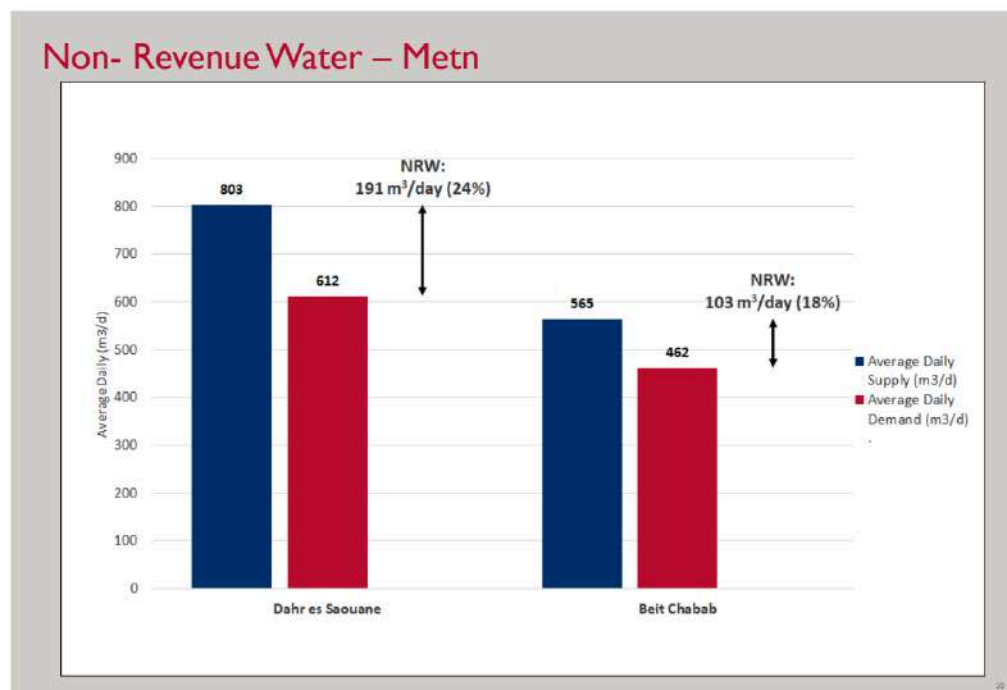
Figure 23 : Non Revenue Water measured for two zones of Metn Region

2.3.7. MAIN SHORTCOMINGS IDENTIFIED

2.3.7.1. VISION OF BMLWE MANAGEMENT

Exchanges with Technical Directorate management have shown that BMLWE is mindful that they used to have a good SCADA infrastructure. Their vision is to put the supervision back in function, while considering theses elements:

- **Lack of qualified employees for SCADA operations**, the current operators lack of SCADA knowledge and as the maintenance contract is no longer applicable, SCADA skills will become crucial for for future implementation and O&M ;
- **Lack of vision on existing control equipment**, the status of on-site control equipment is unknown (deteriorated, missing, etc) ; Therefore, the supervision cannot be brought back into operation by only providing energy to controllers. This task will require a thorough assessment of all existing controllers to know their availability and condition.
- **Need to give more control to operators on-site**, the previous SCADA system was too dependent on the water distribution program and distant commands.

Additional needs of the establishment are the following:

- **Integrate CCTV in the control room**, BMLWE identified that operators would like to have access to CCTV on a workstation in the Control room ;
- **Set up preventive maintenance for SCADA equipment**, There used to be preventive maintenance for controllers before the shut down of central supervision.

2.3.7.2. 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
Ambition about SCADA development; **Existing infrastructure** with good quality hardware and software. - Greater Beirut SCADA **project approach** in phases.	- SCADA **out of service** due to discontinuity of **power supply.** **No SCADA skills** in automation available in the Establishment. - Existing system **designed for distant control from control room**, with no programmed logic in the PLC. **Technical inconsistency** between existing SCADA and future projects. **Lack of documentation** of the existing SCADA
Opportunities	Threats
Existing SCADA system that could be restarted **with limited funds**. **Quality** of **SCADA tender documents** enabling **BMLWE SCADA standards** to be defined.	Unavailability of the needed **budget** for the desired SCADA system,

2.3.8. RECOMMENDATIONS FOR SCADA IMPROVEMENT

2.3.8.1. GENERAL RECOMMENDATIONS

The diagnosis of the SCADA has led to a number of recommendations, detailed as follows.

In priority, SEURECA recommends carrying out a global feasibility studies to :

- Assess the status of the existing SCADA equipments (including the local ones) and the possibility to add solar panels to each site with discontinuous power,
- Perform a cybersecurity audit of the system in order to secure it against growing cyber attacks threats,
- Verify that :
  - the SCADA software (Clear SCADA) is upgradable and still maintained by Schneider to take in account the remaining sites not yet supervised,
  - the existing infrastructure can handle all BMLWE sites
- Detail all possible upgrade to the system to meet SCADA modern standards and improve operability of the system such as:
  - SCADA server hardware refresh,
  - Server virtualization,
  - Automatic functions to be added to the local PLC so the site are less depend on the remote control from the SCADA operator,
  - System to be modify so operator have more easily access to local control of the equipment (local mode),
  - Data logger instead of PLC and RTU for sites only requiring monitoring,
  - Backup control and server rooms, in case of issue in Beirut main office.

- Estimate the budget and duration for all the mandatory work to be performed to restart the SCADA,
- Estimate the budget and duration enhance the system and extend to all sites of BMLWE scope.

Then from the feasibility study and according to the budget available, contract the companies able to perform the corresponding activities and maintain the system once up and running again.

Regarding the Ashrafieh project, it is recommended to:

- Update the specification so it is consistent with Greater Beirut SCADA in terms of hardware, software and approach,
- Add the missing requirements listed in 2.3.3.,

2.3.8.2. 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	Rebuild the previous SCADA team and complement it with : Instrument and control engineer and technicians or with a supporting company to supervise the different SCADA implementation stages and do system maintenance	1-2
Skills	Train operators to have the knowledge to operate locally the SCADA equipment	2
Tools	Carrying out a global feasibility studies, to bring the existing SCADA back into service, to improve it and extend it to the other installations of BMLWE (refer to detail of previous paragraph "General recommendations")	1
	Bring the existing SCADA back into service and improve it as required following the feasibility study,	1-2
	Extend the existing SCADA to the other installations of BMLWE following the feasibility study,	2-3

Processes	Create a BMWE SCADA standard specification based on Greater Beirut project to be applicable to any SCADA project within the establishment and update accordingly the Ashrafieh project specification (refer to detail of previous paragraph "General recommendations")	1
	Create a list to track the existing Instrumentation & Control equipment: brand, model, installation date, location, etc	2

Table 6: List of recommendations for SCADA improvement

2.4. CUSTOMER MANAGEMENT BUSINESS PROCESS

2.4.1. MANDATE

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

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

There is currently no formal "billing activity" as BMLWE does not issue any bill to the clients; however BMLWE already has the necessary digital tools to implement a billing process. The invoiced amount is monitored at the Finance directorate level, and customers debts are followed up thanks to the customer database.

As there are few domestic meters in working order (except for those in the pilot projects, whose consumption data is not used to bill the customers concerned), meter reading cannot currently be considered as part of the scope of this business process. However, if the pilot project leads to transition towards metered consumption, an update of the current database structure and of customer management processes will have to be considered.

2.4.2. ORGANISATION

The Customer management activities are divided among two directorates:

- The Financial directorate:

  - whose "Billing and revenue collection department" is in charge of:

    - Cash collection monitoring and reconciliation between customer database and cash desks;
    - Calculation of invoiced income for the financial statement;
    - Customer database management (special updates not authorised in subscribers divisions of the branches, debt negotiation, etc).

  - whose "Income control department" is in charge of:
    - Monitoring the income and other KPIs such as the number of clients;
    - Controlling the unusual operations (debt cancellation for instance).

- The Distribution directorate:

  - whose "Subscriber management division" is in charge of:

    - Manage new contracts;
    - Update customer database (for usual operations);
    - Collect payments at the office and with cash collectors;
    - Follow-up the debts;
    - Receive and manage customers complaints;

○ whose "Distribution control division" takes part in the new contracts management process (on-the-field assessment for the installation of a new connection).

In addition, BMLWE has a **hotline department**, which reports directly to the General Director. The hotline offices are located in Hazmieh offices, East of Beirut, and run by Mrs. Tina Rizkalla. This department is the point of entry for customers and other outsiders: It centralises complaints and requests, redirects them to the appropriate departments and monitors their progress.

The overall organisation of customer management activities is presented below:
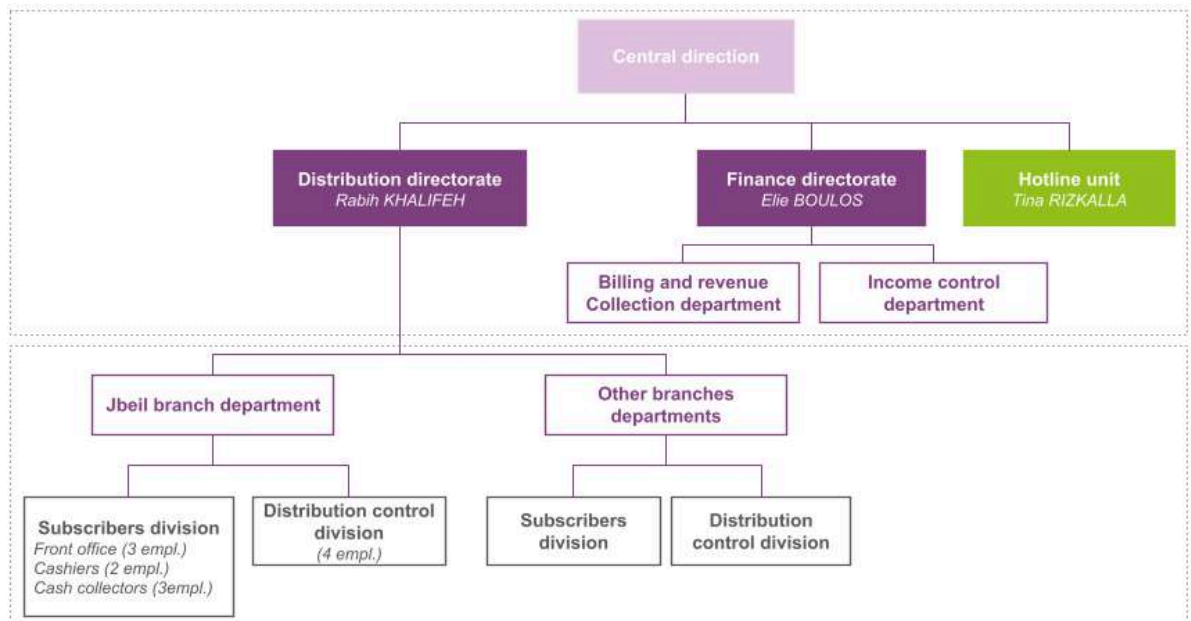
Figure 24: Organisational chart of the departments involved in Customer management

This organisation, partitioned between different directorates, complicates the application of a clear, unified commercial strategy, in terms of both sales, customer information update and digital tools management.

2.4.3. ASSESSMENT OF SUB-PROCESSES DIGITALISATION STATUS

Based on the interviews and 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 identify the status of digitalisation of each one and the main shortcomings in the current situation.

Manage new contracts	
Tool	None
Users	-

Uses and Shortcomings

- To subscribe a contract with BMLWE, the new user has to come to the office with copies of the required documents for application → Online application is not available.

- The contract is made on a paper form template (see picture below), and the BMLWE's employee fills in with the client at the office. All the application process is then followed on this paper form. This includes:
  - the validation of the information by the distribution control division → no digital monitoring of the progress of the required controles;
  - the monitoring of the installation of the new connection → no digital monitoring of the progress of the connections installations;
  - the signature by the Director → no digital validation workflow.

- When the application is completed, the new customer is registered manually, based on the form information, in EBLM subscription manager and a unique number is assigned to him automatically.

- All contracts are archived on paper form at the office. → risk losing part of the information if not registered in the database.

Figure 25*: Illustration of contract application*

The lack of digitalisation of this process leads to several shortcomings:
- It prevents BMLWE from quickly identifying some potential blockages of the application at any stage.
- It degrades customer experience (no vision of the progress of their application, necessity to come to the office sometimes several times, potential delays, etc.).
- The manually registering of the new client into the database can lead to data entry errors, and requires additional work by the employees.
- In addition, it can lead to having connected users that are not entered in the Billing and Collection system and therefore not billed for water.

% of Digitalisation of the process	20%
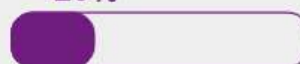
Consolidate customer information	
Tool	EBLM subscription manager (in house software)
Users	Subscribers division of branches, Billing & revenue collection department

Uses and Shortcomings

- Customer information is consolidated in EBLM subscription manager, BMLWE's custom SQL customer database.
- The SQL database enables to visualise all basic information about a customer (see picture below), including paid and unpaid invoices and location of the client. However, the database is:
  - not connected to GIS →it does not enable to visualise the customers on a map;
  - not connected to the CRM (Cisco agent) → it does not enable access to the history of the customer complaints and requests.

- To update customer information, the employees at the branches can only perform the basic operations, on a customer demand who has to pay for it (if this is not a mistake from BMLWE). They report each modification to the headquarter on paper forms, so it can be consolidated in the collected revenue.

- For special operations (debt negotiation, tariff modification, etc), it has to be done by the Billing and revenue collection department, based on the paper form filled in by the branch's employees. → it does not enable to properly monitor if the modification has been made and can lead to potential errors.

- Part of the paper contracts, previous to EBLM subscription manager, are not registered in the customer database, which prevents the related clients from being billed and lead to commercial losses.
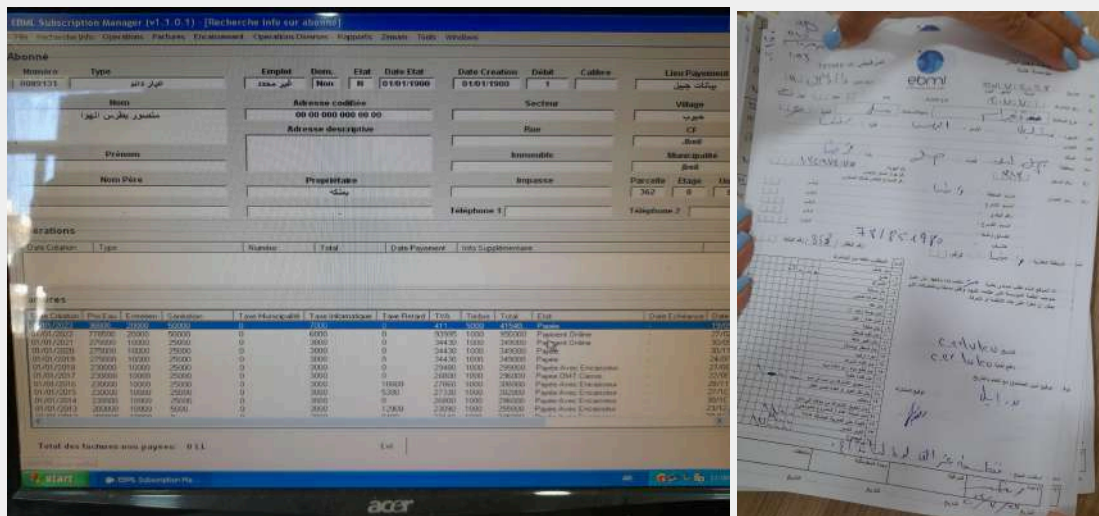
Figure 26: *Illustration of the EBLM subscription manager interface (left); example of paper form for special operation/customer information update (right)*

% of Digitalisation of the process	60%
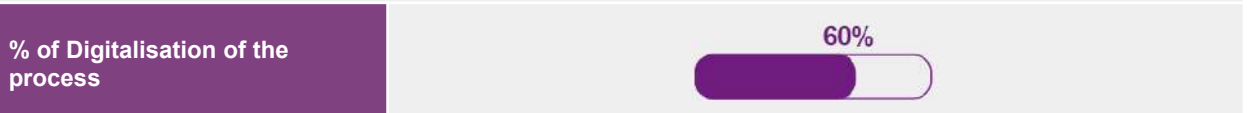
Manage billing	
Tool	EBLM subscription manager in house software; Microsoft SQL server management studio
Users	Subscribers divisions, Billing and revenue collection department

Uses and Shortcomings

- BMLWE does not issue proper invoices to their customers. The yearly tariff is automatically calculated in EBLM subscription manager, based on the diameter of the gauge and the tariff grid. The payment receipt, printed from EBLM subscription manager, is used as an invoice. (See picture below)

- EBLM subscription manager does not enable to automatically consolidate a monthly invoiced amount in the financial ERP. The Billing and revenue collection department manager extracts it annually from the software on an excel report, using SQL request as she does not have direct access to it. The invoiced amount calculated is then entered manually in the ERP.
  → This can lead to potential errors and require additional work from the employees.

Figure 27: *Illustration of a payment receipt*

% of Digitalisation of the process	60%

Manage revenue collection	
Tool	EBLM subscription manager in-house software, online payments tools, OTM
Users	Subscribers divisions, customers, Billing and revenue collection department

Uses and Shortcomings

- BMLWE offers 4 channels of payment:
  - Online payment from the website → not available anymore, to prevent cyber attack (firewall system to be upgraded);
  - OMT payment terminal → not available anymore, to prevent cyber attack (firewall system to be upgraded);
  - Payment at the BMLWE offices;
  - Door-to-door cash collection.

  Income from all channels are consolidated in EBLM subscription manager, which enables a proper payment monitoring per customer.

- When a customer asks to pay, payment receipts are printed from the software. Once the receipt is printed, the related revenue is consolidated in the total amount of cash collected. As a consequence, if the client finally cannot pay or contest the amount, the employee has to make a rollback and send the "false" payment receipt to headquarters with the relevant form. This procedure is complicated and could be simplified.

Cash collector management:

See on the figure below, the details of the process.

The fact that cash collectors have no mobile device connected to the customer database to report data from the field means that they have to use a paper-based system and enter information into the database manually. In addition, in the case of the Jbeil branch, this system required additional excel tracking of invoices printed and not returned by the cash collector.

→ **This process is a waste of time for the employee in charge of follow-up; it increases the risk of inputs errors in the database, and creates a real risk of lost receipts.**

Even if BMLWE has a dedicated tool for Revenue collection monitoring, this process is still mostly managed manually (on excel or on paper) due to a lack of on-the-field tools for on-site revenue collection. Therefore it % of digitalisation cannot reach 60%.

% of Digitalisation of the process	50%
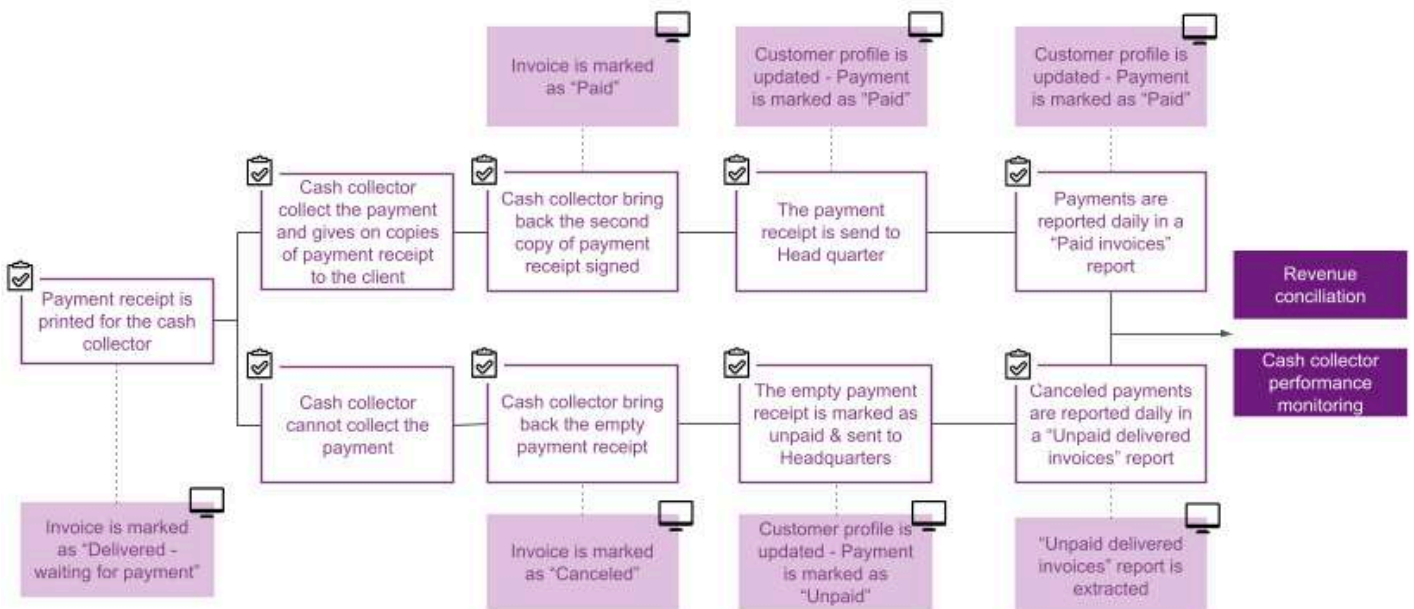
Figure 28: Overview of the revenue collection by cash collectors process

Manage customers claims	
Tool	Cisco CRM
Users	Hotline department, branches subscribers divisions

Uses and Shortcomings

- The Cisco CRM does not communicate directly to EBLM subscription manager, however the employees of the hotline have access to the customer database and can find the customer thanks to its phone number (if registered) or name.

- The CRM enables dispatch of the claims to the different branches, however it cannot create a work order automatically. As a consequence, the paper work order has to be printed.
- The CRM enables BMLWE to monitor the claim status through a dashboard.
- To close the claim, the hotline operators have to call the client and manually close it after its confirmation.

→ The Cisco agent could enable a totally digitised process, however the lack of CMMS capable of issuing work orders imposes a paper-based stage that prevents the implementation of fully integrated claim monitoring.

- It has been observed that, in the branches, front office employees had their proper claims follow-up on excel in parallel with the use of the Cisco CRM for the claims received by phone or at the branch office. This suggests that there is a lack of change management regarding the use of the cisco agent or that the authorizations given to the branch's employees are not sufficient to enable a proper request management. (They cannot open or close a claim by themselves)
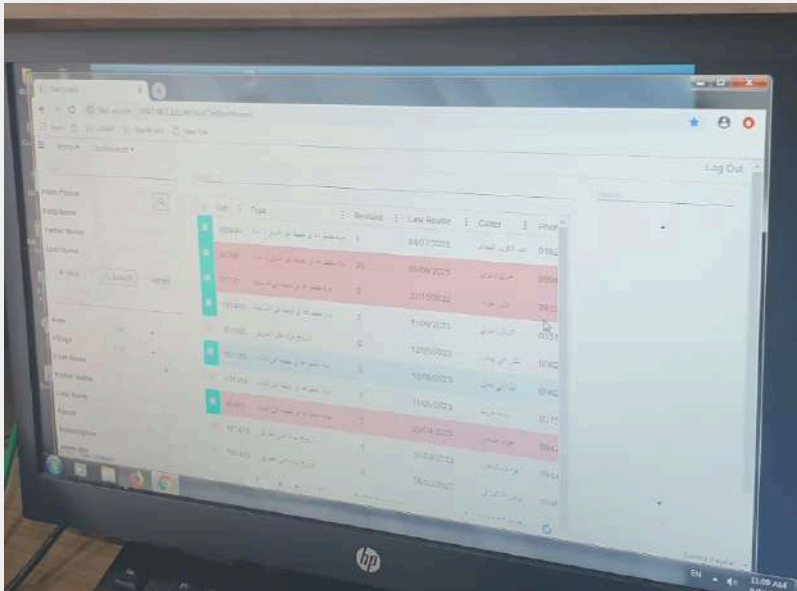
Figure 29: Screenshot of the claim status dashboard

% of Digitalisation of the process	60%

Communicate with clients	
Tool	Online website, mobile app,
Users	all customers

Uses and Shortcomings

- To communicate with its customers, BMLWE uses its corporate website. It enables the clients to be aware of:
  - Current and upcoming projects;
  - information on applications for various operations (new subscription request, subscription cancellation, etc);
  - Hotline number;
  - Current bids.

- The website offers access to personal accounts (visualisation of invoices, consumption monitoring for metered customers, access to some applications available). However this functionality is currently out-of-order due to maintenance issues.

- However, this website does not seem to be integrated with other BMLWE softwares (customer database, Cisco agents, etc). So the information needs to be updated manually.
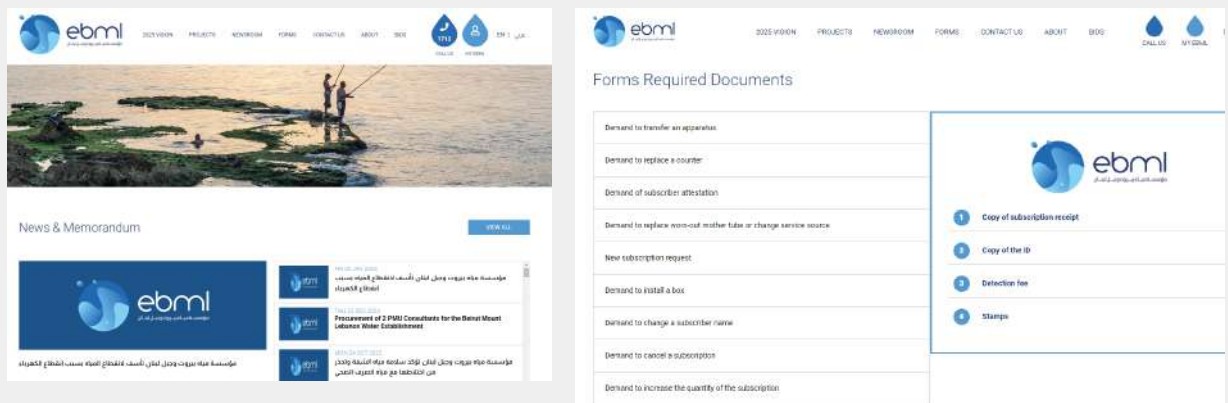
Figure 30: *Screenshots of the EBML website*

% of Digitalisation of the process	60%
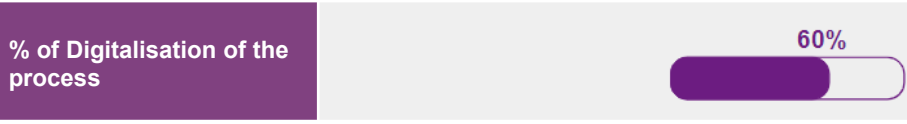
The Appendix 1 presents the assessment of the digitalisation of the customer journey.

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.

Customer management

Figure 31: Digitalisation overview of the Customer management sub processes

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
• **Existing software**, used in headquarters and in branches; • **Multiple channels of payments** (even if some are not currently working) to facilitate customer journey; • Employees' apparent **willingness to move to a paperless system**; • Existing **hotline and online website** which facilitate customer journey; • Existing EBLM subscribers management system could enable the implementation of billing.	• **On-the-field information is reported through paper reports** → necessity to manually enter data in the softwares; • There is a **lack of automated data flows between softwares** (EBLM subscription manager and ERP; EBLM subscription manager and Cisco); • **New contracts management process is totally paper-based**; • **Communication with other departments** (Finance, operations, etc) **is paper-based** when not oral; • **Uncomplete customer database**; • There is **no communication with GIS for customer register** (neither through reports nor through the integration of the GIS with the EBLM subscription manager); • **Digitised processes are still backed up with paper-based procedures, or excel sheets**.

Opportunities	Threats
● The IT department has a project of replacing the EBLM subscription manager by a module integrated in the ERP. ● Online and OTM payments could be reactivated when the maintenance issue will be fixed → improvement of customer journey	● Economic crisis in Lebanon, which limits the budget available for BMLWE.

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.

Category	Recommendations	Priority
Organisation	Set up a Customer management directorate, to provide BMLWE with an integrated commercial strategy	1
	Set up a special team in charge of customer regularisation	1
Skills	Train commercial staff to the new digital tools *(integrated Billing & Collection system, on-the-field device, etc.)*	1
	Train commercial staff (specialised team) on the utilisation of GIS data for customer regularisation	3
Tools	Integrate the Billing and Collection system (EBLM subscription manager) to the ERP	1
	Get online and OTM payment channels up and running again	1
	Install a new contract management module in the Billing and Collection system (to enable filling in the contract on the software and then print it)	1
	Implement digital tools for cash collectors and controllers (for new contract)	2
	Implement digital validation workflows in the Billing and Collection system	2

	Integrate Cisco CRM to the ERP (Billing and Collection system module)	3
Processes	Digitise the contracts still on paper that are not in the customer database	1
	Implement a procedure for systematic customer information update and regularisation campaigns	1
	Implement a formalised billing process	2
	Simplify the Cash collector tours process, thanks to extraction from billing and collection system	2
	Implement a procedure to enable the request/claims reception at the branches level	3

Table 7: List of customer management business process recommendations

2.5. FINANCIAL & ACCOUNTING BUSINESS PROCESS

2.5.1. MANDATE

BMLWE presents one department involved in Financial & Accounting, whose main scope of activity is:

- Revenues reconciliation and control;
- Budget elaboration and cost control;
- Accounting and financial reporting;
- Payroll management;
- Assets financial management;
- Cash management.

2.5.2. ORGANISATION

This department reports to the Director general, as shown below,:
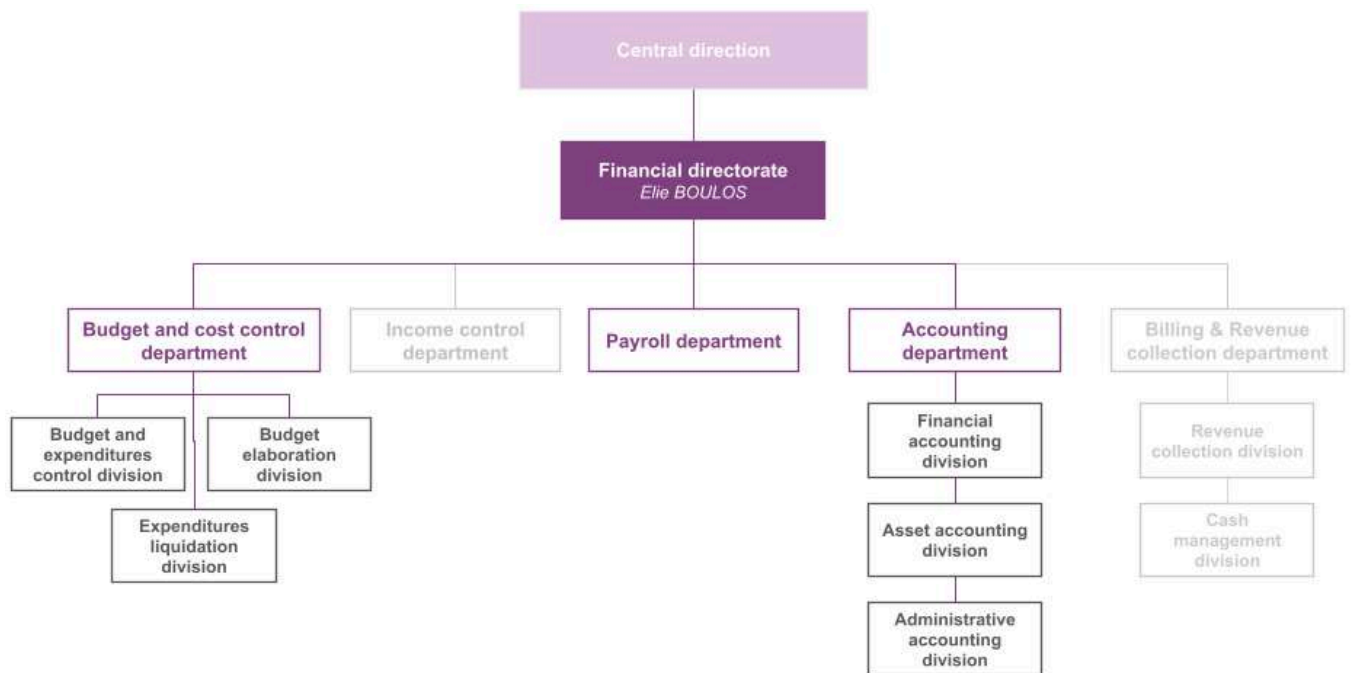
Figure 32: Organisational chart of the departments involved in Financial & accounting
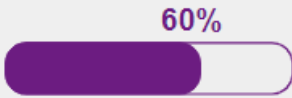
The **budget & cost control department** is in charge of:

- Approving the expenditures demands regarding the budget available and the cash available on BMLWE's bank account,
- When approved, liquidate the expenditure.

The **Accounting department** is in charge of issuing the financial statement of the utility, which includes the management of the fixed assets database and the calculation of depreciations.

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 table 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 Dynamics 365 Navision
Users	Finance directorate

Uses and Shortcomings

- The budget is elaborated on the ERP, based on the expenditures of previous years and projections. However the ERP cannot make the projections automatically, this has to be calculated separately.

- Budget execution reports can be issued from the ERP automatically. They are used to control the feasibility of the requested expenditures.

- BMLWE has a **strong process of cost control**:

  - Each demand of expenditure has to be approved by the Finance directorate regarding the budget available, by the relevant department, and by the General director. However, as the process of validation implies different departments, it is **still on paper despite the fact that it could technically be done on the ERP**.

  - After expenditure control regarding the budget, the Finance department **checks the cash available in the bank account for final validation** of the expense and to make the necessary provision for the future payment. **This is facilitated by the ERP enabling access to bank statements.**

- According to our interview with the IT department, the different costs and their evolution can be visualised on the ERP, thanks to a dashboard.

% of Digitalisation of the process	60%

Manage accounting	
Tool	ERP Dynamics 365 Navision
Users	Finance directorate

Uses and Shortcomings

- Accounting and Financial reporting are made on the ERP.

- The ERP enables to consolidate the expenditures, once validated, in the chart of accounts, when entered into the system.

- **The invoiced revenue has to be calculated apart from the ERP, based on SQL request of the EBLM subscription manager system, and manually entered,** which triggers a risk of error and represents a waste of time. However, **at the end of the year, for the closing of accounts, the yearly invoiced amount is pushed up automatically from the EBLM subscription manager system to the ERP**, which enables a control of the amount previously entered in the system.

% of Digitalisation of the process	**80%**

Ensure revenue reconciliation & monitoring	
Tool	EBLM subscription manager in-house software, excel, ERP Dynamics 365 Navision
Users	Finance directorate

Uses and Shortcomings

- All branches send daily to the Head Quarter:
  - A report on the cash collected during the day, printed from EBLM subscription manager;
  - The payments receipts;
  - The cash collected.
  The Billing and revenue collection department checks the consistency of the information in the software and the receipts received, and calculates a daily amount of revenue collected. This data is entered manually in the ERP once validated.
  → **the lack of automated data flows between the two softwares leads to additional work and potential errors or information losses due to the use of paper reports.**

- The **access to Bank statements through the ERP** enables the Budget and cost control department to double check the collected revenue reported (with some days of delay).

- The amount of debt of each customer can be visualised by checking his profile in the EBLM subscription manager. However, the current process and the lack of communication between EBLM subscription manager and the ERP make it **impossible to match deposits with invoice payments. Yet this functionality is key to tracking debts and revenues.**

- However, **neither the ERP nor the EBLM subscription manager software can calculate the collection rate automatically** and display it at a glance on a dashboard. The daily or, at least monthly monitoring of this KPI, is key to ensure efficient revenue collection in order to detect and correct deviations at an early stage. In BMLWE's case, ensuring sufficient and rapid cash inflow is all the more key that expenditure is conditional on the cash available in its account.

If the revenue reconciliation process relies on dedicated software, the process is still mostly based on paper, due to the issues presented above. Therefore the % of digitalisation of the process cannot reach 60%.

Figure 33*: Illustration of a word daily revenue collected report (left) and Illustration of the revenue collected daily report from Jbeil branch (right)*

% of Digitalisation of the process	50%

Manage assets financial recognition	
Tool	ERP Dynamics 365 Navision
Users	Finance directorate

Uses and Shortcomings

- BMLWE has a fixed asset database registered in the ERP. However,
    - The **current database is incomplete** and the employees in charge of its management struggle to obtain the required information, due to:
        - a **lack of formal reporting procedures between O&M and Asset accounting division**.
        - The fact that the **ERP does not communicate with any other software (GIS, no CMMS).**

When obtained, the information is on paper and has to be entered manually in the system. **The Financial department struggles to collect information about the status of the assets, and so for the financial recognition the assets cannot be properly done.**

    - The database is **still on the previous version of the ERP (2013)**.

With appropriate communication with other software, or at least formal reporting procedures between

the departments, the ERP could offer the technical possibility to have a proper fixed assets financial management.

% of Digitalisation of the process	60%
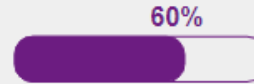
Human Resources: Payroll (Manage Payroll)	
Tool	ERP Dynamics 365 Navision, Microsoft excel
Users	Finance directorate, Joint affairs directorate

Uses and Shortcomings

- The ERP registers all information about the permanent workers, necessary to **automatically calculate their payroll**. (see picture below). The promotions are calculated automatically in the ERP, based on the usual grades of public workers.
- The **daily workers are managed in an excel database**, and their payroll is directly managed by Joe Maroun.
- The ERP is used by the Payroll department (Finance directorate) to **consolidate the information (overtimes, attendance, leaves)** reported by the other departments, after validation by the General director, and to automatically issue payslips.
- **All information provided is on paper reports and entered manually into the system**.
  - The overtime and leaves are reported by the head of each department who follow it on excel. There are no procedures regarding overtime calculation.
  - The attendance is reported by the HR department, and calculated thanks to the Time attendance software, linked to hand push (See in chapter 2.6.3).

- The payslips are issued on paper and given to the employees.

The fact that the **process is still managed mostly on paper is due to several causes**:
- There is **no communication between the Time attendance monitoring software and the ERP**.
- The **chiefs of departments have no access to the functionality of declaring overtimes or leaves** in the ERP, because all communication between department and validation has to be made on paper.
- The **daily workers are not managed through the ERP**.
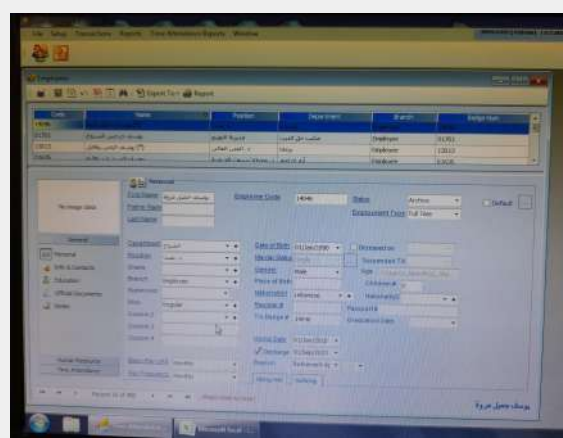
Figure 34*: Illustration of the profile of a permanent employee in the ERP*

Figure 35*: Illustration of paper payslip*
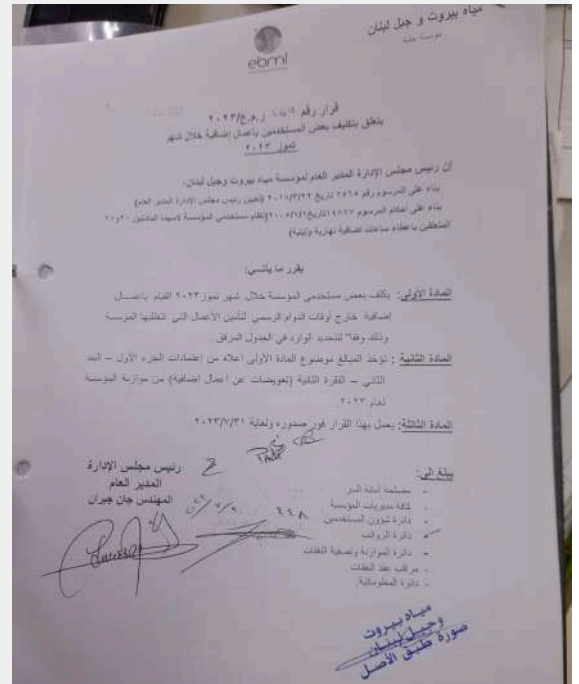
Figure 36*: Illustration of a declaration of overtimes and leaves for department*

| % of Digitalisation of the process | 60% for permanent employees |
| | 40% for daily workers |
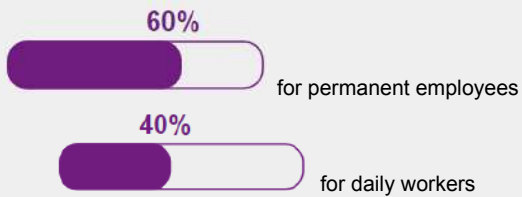
2.5.4. SUMMARY

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.

Financial and Accounting

Elaborate Budget and control budget execution	60%
Manage accounting	80%
Ensure revenue reconciliation & monitoring	50%
Manage assets financial recognition	60%
Human Resources: Payroll	60%
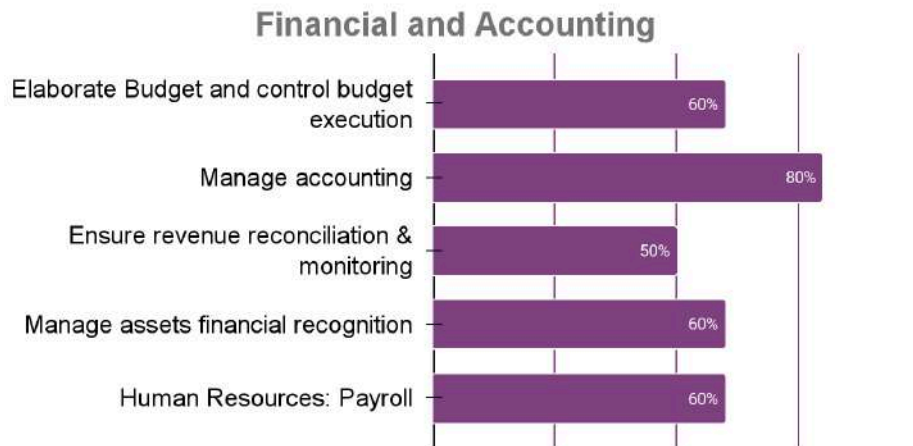
Figure 37: Digitalisation overview of the Financial & Accounting sub processes

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
• The **ERP has all basic functionalities** for correct accounting and financial reporting; • The **ERP is used by the employees**; • There is a **willingness of the employees to develop the use of the ERP**.	• The **ERP is not integrated to other softwares**, which requires manually entering the data. (payroll, expenses, etc.); • **Lack of automated revenue reconciliation** which can lead to various errors; • All **validations workflows and communications between departments are still made on paper**; • There is a lack of strict reporting procedures between technical/O&M departments, which **complicates the financial recognition of the assets**; • The **fixed assets database is out of date** - last full update was in 2012; • The **managers and other departments** (apart from Finance directorate) **have no access to the ERP** and cannot

Opportunities	Threats
	enter data by themselves.
● The **Microsoft Navision ERP offers a lot of functionalities**, some modules could be added to perfect the current version.	● **Economic crisis in Lebanon**, which limits the budget available for BMLWE; ● The **2013 fixed asset database** is registered in an out-of-date version of the ERP; ● There is a **lack of clarity about the legal requirement to keep a paper trail** of every expense/purchase/contract etc.

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.

Table 8: List of IT management business process recommendations

Category	Recommendations	Priority
Skills	Statute on the legal obligations regarding the ministry guidelines to keep paper versions of documents concerning expenses, contracts, purchases, etc	1
	Train all ERP users with validation power to the use of digital validation workflow	2
	Training of the Head of branches to the use of the ERP, once the access is provided	3
Tools	Integrate the in-house Billing & Collection system to the ERP (or develop a Billing and Collection system module in the ERP)	1
	Implement digital validation workflows in the ERP	2
	Migrate the Fixed asset database on the 2018 version of the ERP	2
	Provide access to the ERP to identified managers (Head of branches for instance)	3

	Integrate the monitoring of staff attendance, leaves, and overtime to the ERP payroll module	3
Processes	Implement reporting procedures between operations and finance for assets condition financial recognition and a fixed asset registering campaign	1

2.6. ADMINISTRATIVE, HR BUSINESS PROCESS

2.6.1. MANDATE

The HR division carries out the following operations:
- Tracking working hours;
- Leave time tracking,
- Monitoring absences (justified and unjustified).

Payroll is handled by the Finance department. This department is also responsible for Health and Safety.

The Procurement and legal affairs division carries out the purchase and supply procedures for the whole of BMLWE, in close relation with the operational departments (operations and technical), the finance department, and the Auditing authority.

2.6.2. ORGANISATION

This directorate is called the "Joint affairs directorate" and reports to the Generale Director, as shown below:
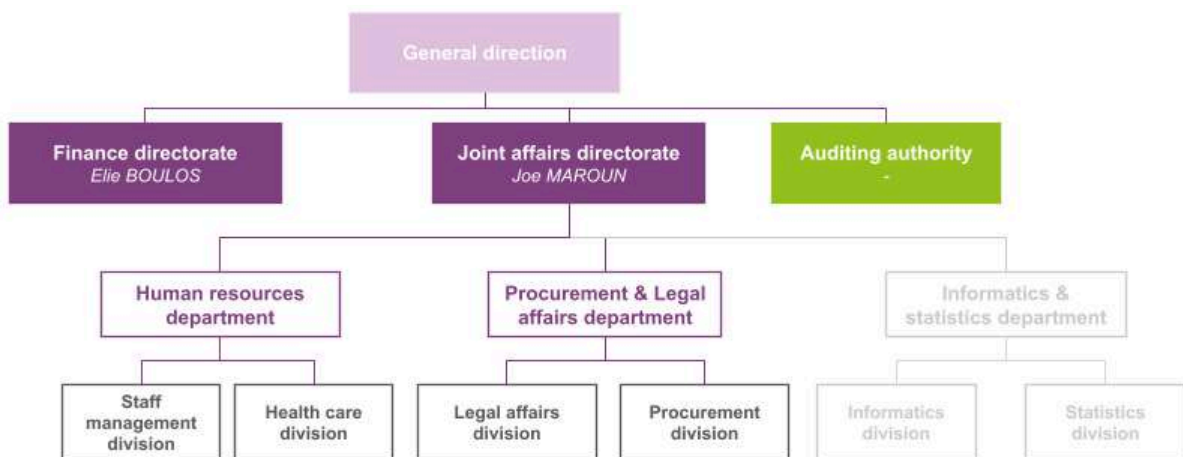
Figure 38: Organisation chart of Administrative, legal and HR activities

2.6.3. ASSESSMENT OF SUB-PROCESSES DIGITALISATION STATUS

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

HR Management	
Tool	ERP Dynamics 365 Business Central + Handpunch /Time attendance system
Users	HR division (Joint affairs department), Payroll (Finance department), all Staff (for Handpunch tool)

Uses and Shortcomings

Attendance monitoring:
The attendance of employees is reported by the HR department to the Payroll department and **followed up thanks to a handpunch system**.

As the **ERP does not communicate with the handpunch system software, a report has to be done by the HR department**.
- The current configuration of the time attendance system does not automatically extract the number of hours worked per employee. However it is possible to do it manually from the system. Unfortunately the user profile of the HR employee in charge of collecting the worked hour only allows her to extract the arrival and departure times. Consequently, this employee has to calculate the corresponding time spent on an Excel sheet, for each of the 200 permanent employees.
- The justified absences are reported and validated on paper and then consolidated on the attendance excel sheet by the HR department.

→ This triggers a **significant waste of time and risk of error**.

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).

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 is **no recruitment process**. It is managed by the General director.
- There is **no individual performance monitoring process**.
- There is **no training management process**.

If the time management process uses a dedicated software, it is still mostly based on paper and manual calculation on excel, due to the issues pointed out above. Moreover some HR processes are not digitised at all. Therefore the overall % of digitalisation cannot reach 60%.

Figure 39: *Illustration of the report exported from the time attendance system*

Figure 40: *Illustration of the attendance report made on excel by HR department*

% of Digitalisation of the process	50%
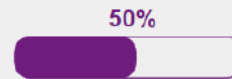
Procurement / Purchase

Tool	ERP Dynamics 365 Navision
Users	Procurement & legal affairs department Finance Department

Uses and Shortcomings

The details of those procedures are presented in the figure 24 below, to facilitate the understanding of the highlighted points.

In the purchase process:

- **Demands for departments are made on paper forms** and then **entered manually into the ERP by Procurement**.
- The procurement department also creates the **purchase orders in the ERP**. They have no vision of the progress status of the orders after their creation, and cannot use it to follow the requests of quotations so they have to f**ollow the progress of the demand on a separate excel sheet**.

In the tender process:

- Terms of reference are written on Microsoft Word, and published on the Company website and on the national website for public tenders.
- Only quotations are entered manually in the ERP when the contract is signed.

The **ERP offers a service provider database**, which provides information about their contact, their usual prices, the purchases made and enables having a **real monitoring of each provider, saving time in the purchase process and streamlining the relations**. However, the **communication with providers is made mostly by phone, which lacks traceability and requires more time.**

A precise and strict workflow is in place with validation processes, however **all validations and communication flows between departments are made on paper, which lengthens processing times and makes it difficult to keep track of the various ongoing operations.**

A need for a database of tenders that would enable keyword searches was raised by the procurement department, in order to save time.
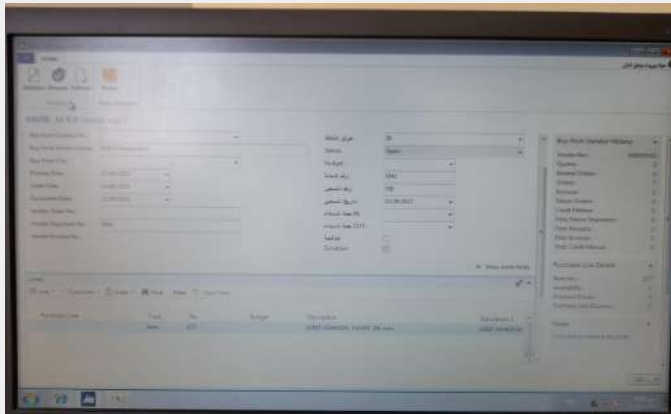
Figure 41: *Illustration of purchase order on the ERP*

% of Digitalisation of the process	60%

Document control	
Tool	ERP Dynamics 365 Navision
Users	All department

Uses and Shortcomings

- **Documents are stored on local servers**. Employees can access different file locations according to their permissions.
- Documents are registered in a **dedicated customised ERP module**, but they are also registered on a **document control register (book)**.
- IT department launched a tender to digitise all existing paper documents and store them on the ERP. This will require the update of the ERP.

% of Digitalisation of the process	60%
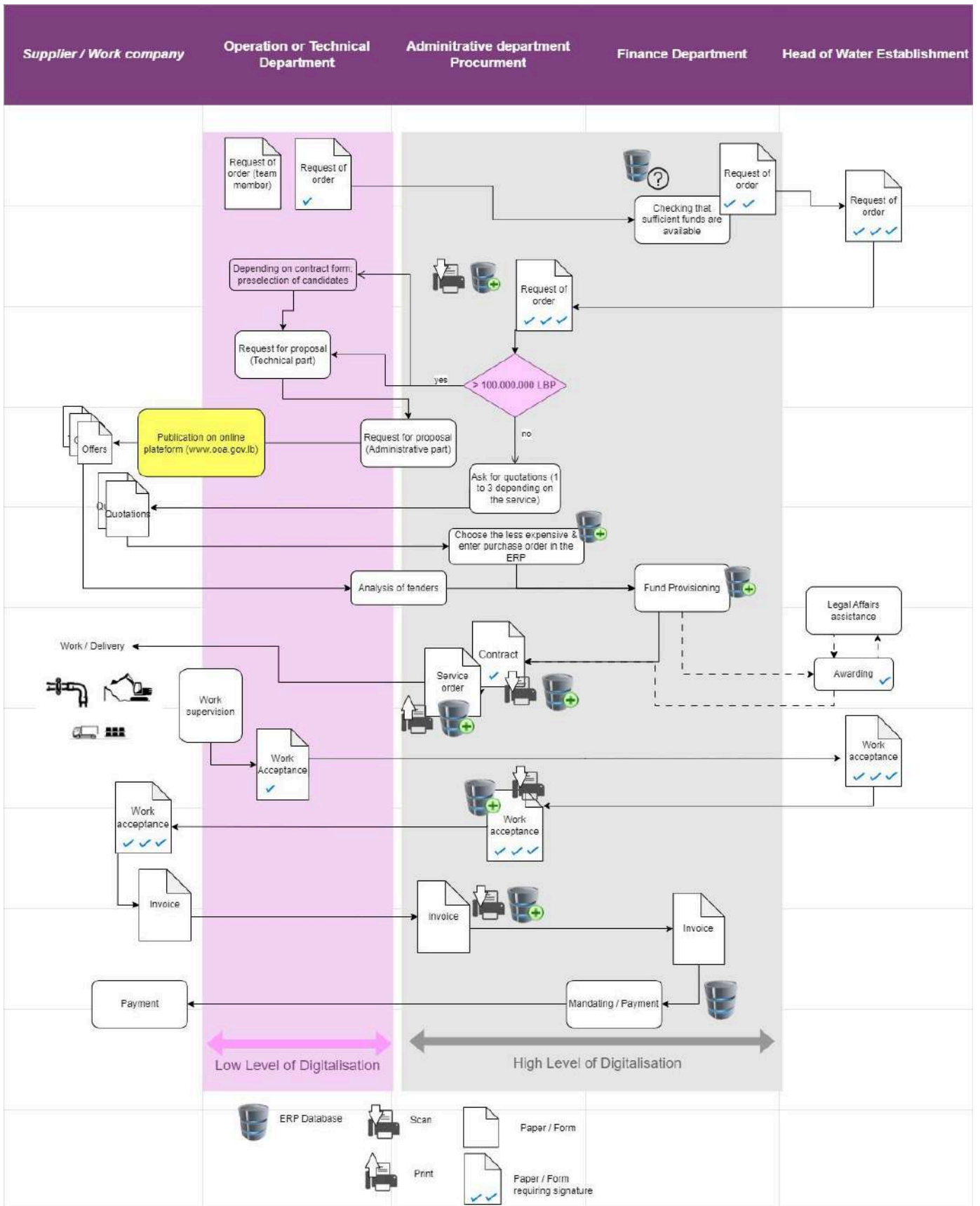
Figure 42: Procurement process

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.

Administrative and cross-functional services

HR Management	50%
Procurement / Purchase	60%
Document Management System	80%
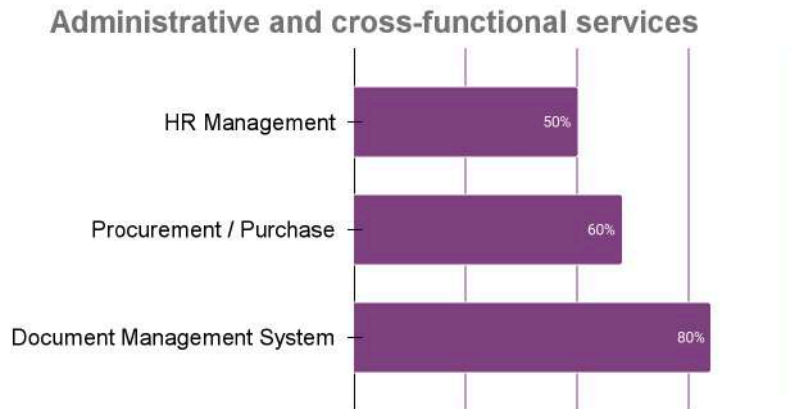
Figure 43: Digitalisation overview of the Administrative, legal and HR sub processes

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
ERP & time attendance software are used by the employees; - The **procurement process is strong** and well-known; - The current version of the **ERP includes a doc control module**.	- The **validation workflows and the communications between departments are still made on paper**; - The **monitoring of overtime and leaves is still made on paper/excel**, and the procedures to do it is unclear; - The **time attendance monitoring software is underused**; **HR information are not totally integrated to the ERP** (overtime, attendance, leaves, etc); - There is **no internal tender database**, which could enable optimization calls for tenders; - The **communication with providers is still mostly managed by phone** → lack of traceability and waste of time; - There is a **lack of formalised Human resources management procedures**,

| | which limits the possibility to digitise this process; |
| | ● The **doc control procedure is digitised** on the ERP but processes are **still doubled with paper**. |

Opportunities	Threats
● The Microsoft Navision ERP offers a lot of functionalities, some modules could be added to perfect the current version; ● The **implemented Time attendance software offers lots of possibilities**, some modules could be added to perfect the current version; ● A **call for tender was launched for the digitalisation of paper documents**.	● **Economic crisis in Lebanon**, which limits the budget available for BMLWE.

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.

Category	Recommendations	Priority
Skills	Train all ERP users with validation power to the use of digital validation workflow	2
	Training employees who have been granted access to the ERP in its use (Head of branches for instance)	3
Tools	Digitalise validation workflows between departments	2
	Digitalise purchase requests	2
	Create an HR module integrated to the ERP to digitalised the overtimes and leaves monitoring (access for employees, managers, and integration with the Time attendance system)	3
	Provide access to the ERP to identified managers (Head of branches for instance)	3
	Digitalise the communication channels with services providers	3

	Create an internal tender database	2
	Purse digitalize tender and deployment of ERP storage feature for BMLWE documents	2
Processes	Streamline HR procedures (recruitments, individual performance monitoring, overtimes and leaves calculations, etc)	1
	Streamline the monitoring of the communications with providers, especially the call for quotations phase.	2

Table 9: List of support services business process recommendations

2.7. TECHNICAL & STUDIES BUSINESS PROCESS

2.7.1. MANDATE

BMLWE has one department involved in Technical & studies, which is the "Project department", part of the Technical directorate. Its main scope of activity is:

- To carry out design studies (mechanical, civil and geological) for small network improvement projects (e.g. tank addition, small pumping system, design network);

- To verify and validated the design made by external companies for larger projects;

- To review the "as-built" drawings of all executed projects, validate them and add them to the projects department database as raw data and in the GIS database;

- To manage the GIS database, customise and develop the necessary GIS tools;

- To supervise the work of contractors on the projects.

2.7.2. ORGANISATION

This department reports to the Technical directorate, as shown below,:

Figure 44: Organisational chart of the departments involved in Technical & studies

Project department is divided into a Studies team and an Execution team.

The studies team deals with all design related work while the Execution team is in charge of subcontractor work supervision. Both teams work in close collaboration on the same projects..

Note: The lead of the Studies team is also the GIS expert.

2.7.3. ASSESSMENT OF SUB-PROCESSES DIGITALISATION STATUS

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

Project Management / Studies management	
Tool	WaterCAD, AutoCAD, Qgis
Users	Project department

Uses and Shortcomings

- Projects are technically followed by the project department but the contractual aspect is managed by the Procurement department (overall progress, financial management) or donors.
- Project department uses various business software such as WaterCAD for hydraulic modelling, Autocad for CAD drawings, Qgis for GIS data and various calculation spreadsheets to design or verify the design of network extension projects.

→While Qgis is open source and can be used freely, it is required to pay licensed fees for the other software which is not currently done.

- For small projects and large ones, the site work is performed by subcontractors which are followed by the project department team.
- Once the work is performed by the subcontractor, the project department ensures that the complete as-built documentation is provided by the subcontractor as well as the corresponding statistics required by law (e.g. number of inhabitants on a parcel).
- There is no internal procedure for project management and design studies performed. The department relies on skill and experienced staff to carry out its activities.

% of Digitalisation of the process	60%

Project department is also responsible for GIS. Please refer to the process "Manage work tasks - Underground Assets" in part 2.2.3 for more information on the GIS management.

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
- **Skilled and experienced staff**; - **Staff is competent and open to digital transformation** through the improvement of software interactions and datsharing.	- **No procedure** to ensure constant deliverable quality; - **Design software licence fees are not paid.**

Opportunities	Threats
	• **Economic crisis in Lebanon**, which limits the budget available for BMLWE and prevent the project department to pay for the licence fees, get additional staff or keep skilled staff to perform department activities activities; • There is **only one staff managing the GIS** which represents a long-term risk.

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.

Category	Recommendations	Priority
Skills	Train a second staff to support the GIS expert and perform the task in his absence	1
Tools	Request donor to finance the licence fees	2
Processes	Implement engineering procedures to ensure constant quality of the deliverables and formalise the knowledge developed over the years	2

Table 9: List of Technical management business process recommendations

3. OVERALL DIGITAL MATURITY DIAGNOSTIC OF BMLWE

3.1. BMLWE'S DIGITALISATION CONTEXT & PAST INITIATIVES

BMLWE currently lacks an existing digital strategy, but is determined to embrace digitalization in order to **monitor and enhance operational efficiency**, to **consolidate access to all information in one centralised location.** Additionally, there is a strong desire to **reduce paperwork** and **streamline processes**. By transitioning to digital platforms and systems, the company will be able to centralise its data, simplify workflows, and ultimately improve overall management and efficiency. Embracing digitization will also help reduce costs associated with printing and physical document storage, while **minimising human errors often associated with paper-based processes**.

3.2. BMLWE'S DIGITAL TOOLS OVERVIEW

3.2.1. SOFTWARES CURRENTLY USED IN BMLWE

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

Tools managed	Version	Use	Used by
Microsoft Dynamic Navision 2018	2018	Accounting, Financial reporting Procurement Payroll	Finance Legal affairs and Procurement
Microsoft Dynamic Navision 2013	2013	Fixed assets database	Asset accounting division *(Finance directorate)*
Microsoft SQL server management studio		Calculation of invoiced amount Debt monitoring Special request to EBLM subscription manager system	Billing & Revenue collection department *(Finance directorate)*
EBLM subscription manager system (c# SQL 2017)	2017	Customer database Revenue collection monitoring Receipts/invoices issuing	Subscribers divisions *(Distribution directorate)*
Cisco Agent		Customer requests management	Hotline
QGIS	3.18.22	Assets visualisation Design studies verification Projects planification	Project department *(Technical directorate)*
AutoCAD Map	2022	CAD drawing	Project department *(Technical directorate)*
WaterCAD	V8 XM	Hydraulic modelling	Project department *(Technical directorate)*

Tools managed	Version	Use	Used by
Barracuda cybersecurity solution		Anti malware, anti phishing and ransomware prevention	All departments
Sophos software		Management of firewalls	IT department
Teamviewer Anydesk		Remote access to computer of user support	IT department
Microsoft Office 365		Data analysis, Reports production	All departments
Time attendance system		Issue entries/leaves sheets from the HandPunch machine	HR department

Table 11: BMLWE's current software

3.2.2. BMLWE'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.
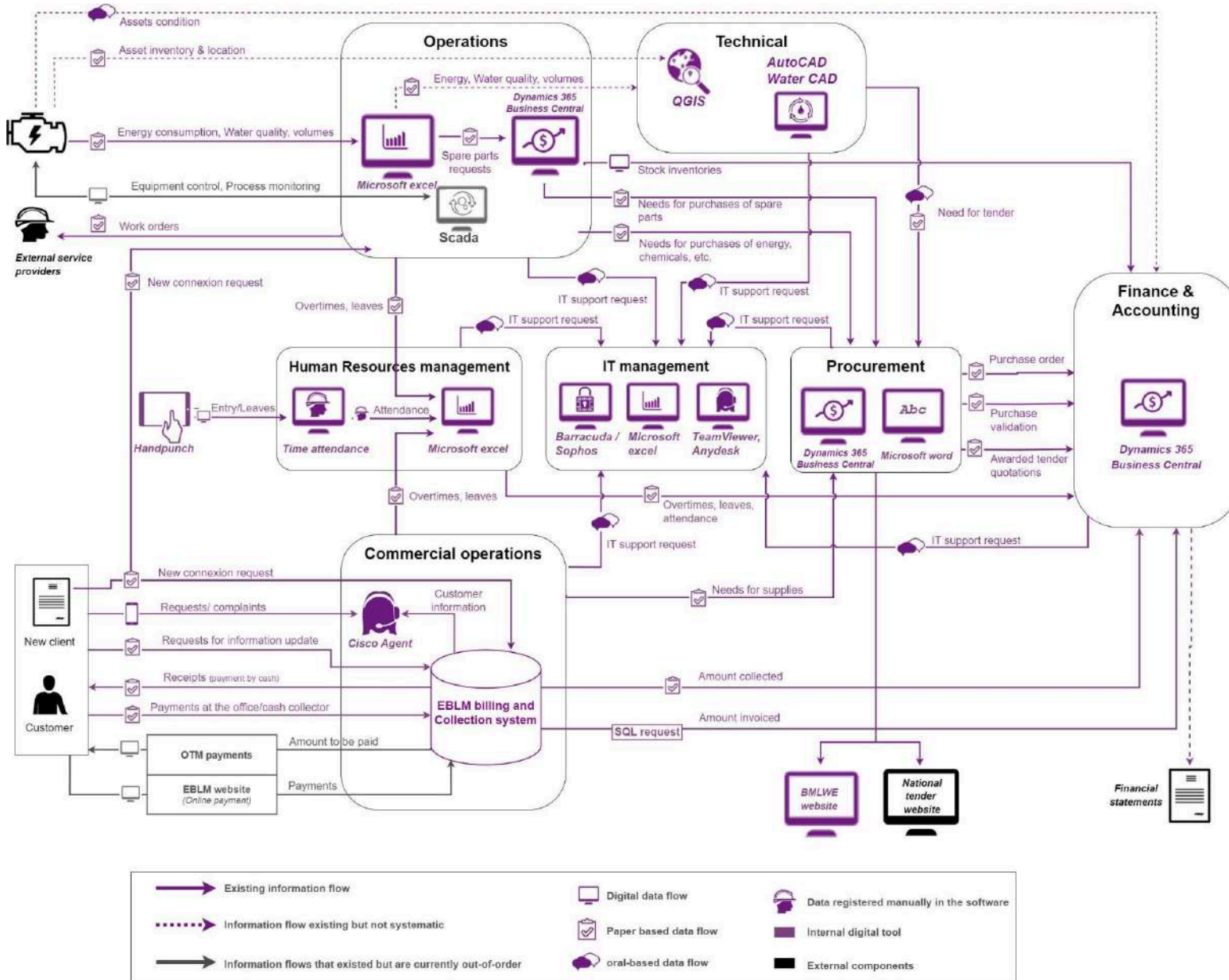
Figure 45: BMLWE's software mapping

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
● Overall **skilled** and **experienced staff** from having been an advanced water	● **No integrated digital tools for on-the-field reporting** → necessity to manually enter the data into the

utility;

- **Robust IT** and **OT** infrastructure;

- **Quality** of **SCADA tender documents** enabling **BMLWE SCADA standards** to be defined**;**

- **Staff** open to **digital transformation**;

- **Quality** and **protected against cyber attack** network infrastructure;

- **Software already implemented and used by the employees;**

- **Willingness to do a good job within the staff**, despite financial means and incentives;

- **ERP implemented;**

- **Billing and collection software well designed and implemented;**

- **Hotline and BMLWE online website** which facilitate customer journey;

- **Comprehensive GIS** and **competent staff to update it.**

software;

- **Lack of automated data flows between softwares** → requires the use of paper forms;

- **All communications between departments, including validation workflows, are made through paper forms** → complicates the monitoring, requires a lot of time and triggers a risk of error;

- **No access to the ERP in the branches** → requires the use of paper forms for any request or any reporting;

- **Lack of reporting procedures between departments nor software in the O&M department** →hampers the transmission of data to all other departments;

- **Incomplete databases;**

- **SCADA out of service** due to discontinuity of **power supply;**

- **No SCADA skills** in automation available in the Establishment;

- **Technical inconsistency** between existing SCADA and future projects;

- **Customer journey to be digitalised** to be a customer-oriented water service;

- **Lack of maintenance of hardware and software** due to the lack of financial resources.

Opportunities	Threats
On-going AFD project; **Existing digital tools to facilitate customer journey which could be reactivated** with appropriate maintenance; **ExistingSCADA system** that could be restarted **with limited funds**; **Quality** of **SCADA tender documents** enabling **BMLWE SCADA standards** to be defined.	**Economic crisis in Lebanon** which limits the budget available for BMLWE; **Recent shortcut of the financial aid for maintenance** leads to a serious lack of motivation among teams; **Lack of clarity about the legal requirement to keep a paper trail** of every expense/purchase/contract etc, which limits the possibility to move towards a paperless system;

	• **Very low salaries in the public sector**, making it difficult to retain and recruit skilled profiles.

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

Table 12: Digital maturity scoring

Based on the interviews with the different departments and the on-the-field observations, the Consultant assessed the current maturity of BMLWE. It is then 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	**Level 2 - "Development"** *Management is convinced of the impact of digital transformation on the quality of service and performance of the Establishment. It has set the course, invested in it and created the basic conditions necessary for implementation, in the last years. However, it has not the necessary budget to pursue this transformation and make it part of an coherent and comprehensive roadmap and action plan*	**Level 3 - "Competent"** *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.*
Technology: Infrastructure	**Level 2- "Development"**	**Level 4 - "Advanced"**

	Current maturity rating	Target maturity state *Horizon 5 years*
/ Architecture / Data / Security	*Despite the absence of IT master plan nor security audit. The existing IT infrastructure and its management is of a very high standard / latest generation. BMLWE has outsourced infrastructure maintenance to expert companies.*	*Documented Business Continuity Plan for critical applications. Managed services interventions are tracked through an intervention management platform. Preventive maintenance tasks are performed, such as software or operating system version management.*
Customer Relation / ERP / Services digitalisation	**Level 2 - "Development"** *The complaints system is centralised (hotline) but not connected to the customer database, the complaints are traced.* *The customer database is incomplete but offers the necessary functionalities for customer operations management. However it is an inhouse software and is not integrated to the ERP. Each customer manager in the sales office is multi-skilled and can handle any type of transaction (multi-skilled).* *Personal accounts & online payment on EBLM website site are existing but currently out-of-order.*	**Level 4 - "Advanced"** *The Customer relationship management is integrated with a maintenance contract and version updates. Complaints are integrated to the centralised customer database. The process of handling requests is dematerialised within the Establishment.* *The customer database is integrated to the ERP., and up-to-date. Each customer manager in the sales office is multi-skilled and can handle any type of transaction (multi-skilled).* *The customer can also carry out any type of operation from an online agency or mobile application.* *The Establishment is active on social media and communicates any operation event.*
Public service / Asset life cycle	**Level 1 - "Aware"** *Existing fixed assets database in previous version of the ERP, partially completed. Depreciations are consolidated in the ERP, based on the current database.* *No permanent update of the asset database. Assets monitored by acquisition contract.* *There is a basic asset condition monitoring. Communication with O&M on the condition of assets is paper-based or oral.* *Fixed asset database is not integrated with the GIS.*	**Level 3 - "Competent"** *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.*
Operation Management	**Level 1 - "Aware"**	**Level 3 - "Competent"**

	Current maturity rating	Target maturity state *Horizon 5 years*
	Existence of an incomplete telemetry system which is currently out of order.	*Existence of a complete telemetry system with alarm and measurement monitoring, remote control operations*
Works Management and Follow Up	**Level 1 - "Aware"** *Strong culture of work monitoring but lack of systematic reporting procedures.* *No monitoring tools. Paper-based reporting.*	**Level 3 - "Competent"** *Existence of a permanent geospatial platform for monitoring works with start-up dates, monitoring of attachments, disbursements, recording of reports and test reports, photo reports. Systematic integration into the equipment and GIS asset database*
Supplier Relation	**Level 2 - "Development"** *All transactions with suppliers are carried out by mail, fax and paper documents.* *Posting of Tenders on the website.* *No internal application for contract management. Financial terms of the contract entered manually in the ERP.*	**Level 3 - "Competent"** *All transactions with suppliers are carried out by mail, fax and paper documents.* *Posting on the website via the supplier platform of the Tenders, downloading of the Tenders and communication of the judgement stages.* *Internal tender and contract management application.*
Supports services digitalisation / Accounting	**Level 2 - "Development"** *Integrated accounting and financial ERP with the functions of purchasing, fixed assets, general accounting, cost accounting, budgeting, works, treasury and payroll, with some links to the asset database and the purchase requests of the various departments.* *No automatic link between Customer database and ERP.* *All validation workflows are made/double on paper.*	**Level 3 - "Competent"** *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.* *No more paper validation workflow.*

	Current maturity rating	Target maturity state *Horizon 5 years*
Staff / HR digitalisation	Level 1 - "Aware" *Working time management thanks to the time attendance system, but not integrated to the ERP payroll module.* *Absences, holidays monitored on a separate excel and manually entered into the payroll software for the production of pay slips.* *No dematerialised procedures for other HR processes (recruitment, work accidents monitoring, etc)*	Level 3 - "Competent" *The dematerialisation of internal procedures enables exchanges via a digital workflow.* *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.* *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.*

Table 13: 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 Maturity grid below). 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 46: Consolidated BMLWE's digital maturity grid

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. DEFINITION OF THE OBJECTIVES FOR THE NEXT 5 YEARS

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 10: 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.

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- "**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 **10-years action plan for BMLWE'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	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	Priority	Complexity	CAPEx**	OPEx	Description
STRATEGIC FRAMEWORK																$1,180,000	$250,000	
SF-1	**Strategy and general organisation**															$60,000	$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**															$90,000	$10,000	
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
SF-2.4	Reinforce cyber security culture through training and regular refresh session	IT2	SF-2.1 SF-2.2		x									Medium	Low	$10,000	-	Training + internal awareness campaign

Action code	Action description	Related Maturity Grid Objective	Prerequisites	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	Priority	Complexity	CAPEx**	OPEx	Description
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	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-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									Low	Low	$2,400	-	Consultancy Yearly updates performed by internal staff
SF-3	**ICT Infrastructure reinforcement**															$510,000	$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-1.5	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
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-2.1 SF-2.2		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

Action code	Action description	Related Maturity Grid Objective	Prerequisites	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	Priority	Complexity	CAPEx**	OPEx	Description
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	SF-3.4 GII-4.4			x	x							High	Medium	$11,500	-	Purchase of hardware & software (firewall, DMZ, etc.) & implementation
SF-4	**SCADA Activities Structuration**															$510,000	$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										High	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									High	High	$4,000	-	Consultancy (SCADA audit + recommendations) including on-site mission
SF-4.3	Update the Ashrafieh project specifications according to the SCADA standards	OP1	SF-4.2		x									High	Medium	$4,000	-	Consultancy including on-site mission
SF-4.4	SCADA internal staff : Remobilise the previous SCADA team of BMLWE	OP1	SF-4.1		x									Medium	High	-	-	Performed by internal staff
SF-4.5	Define I&C Referent job description	OP1	-	x										Medium	Low	-	-	Replication of SLWE Job Descriptions
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

Action code	Action description	Related Maturity Grid Objective	Prerequisites	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	Priority	Complexity	CAPEx**	OPEx	Description
SF-4.8	SCADA external staff : mobilise two SCADA technicians to help for the implementation, operation and maintenance	OP1	SF-4.6 GII-4.4 GII-4.5		x									Medium	Medium	-	$210,000	Outsourced O&M services (2 SCADA technicians)
SF-4.9	SCADA internal staff : Train BMLWE operators to have the knowledge to operate locally the SCADA equipment	OP1	SF-4.6 GII-4.4 GII-4.5		x									Low	Medium	$12,800	-	Training by branch & control room operators
SF-5	**Continuous improvement**															$10,000	$30,000	
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-1.1 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-1.1 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
GENERAL IT/OT IMPROVEMENT																$4,180,000	$50,000	
GII-1	**ERP improvement**															$320,000	$40,000	
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	-	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

Action code	Action description	Related Maturity Grid Objective	Prerequisites	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	Priority	Complexity	CAPEx**	OPEx	Description
GII-1.3	Upgrade the current ERP (Microsoft Dynamics NAV to Microsoft Business Central) as Microsoft Dynamics NAV will soon be obsolete	IT2	-	x	x									High	Medium	$231,000	$37,200	ERP development, testing, support, running External support for project management Licences renewal
GII-1.5	Based on the conclusion of the assessment, upgrade ERP to: - integrate new modules (Ex: purchase requests, tenders database, document management system, HR modules, customer database, 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								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-1.5		x									High	Low	$1,600	-	Performed by internal staff
GII-1.7	Provide access to the ERP to the identified new users (branches managers)	SA1 GOV3	GII-1.2 GII-1.3 GII-1.5		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-1.5 GII-1.6		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.

Action code	Action description	Related Maturity Grid Objective	Prerequisites	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	Priority	Complexity	CAPEx**	OPEx	Description
GII-1.10	Train ERP users to the new procedures	SA1 SA3	GII-1.9		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 processus 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**															$20,000	$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-3.3	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**															$3,840,000	$10,000	
GII-4.1	Create and Maintain detailed asset list of SCADA equipment to be hosted in the ERP inventory module	OP1 OP2 PS2	GII-1.5	x										Medium	Medium	-	-	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	Medium	-	-	Included in SPI-10.1

Action code	Action description	Related Maturity Grid Objective	Prerequisites	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	Priority	Complexity	CAPEx**	OPEx	Description
GII-4.3	Carrying out a global feasibility studies, to bring the existing SCADA back into service, to improve it and extend it to the other installations of BMLWE	OP1 OP2 OP3	-	x	x									High	Medium	$22,500	-	Consultancy (diagnostic recommendations) including on-site mission
GII-4.4	Bring the existing SCADA back into service and improve it as required following the feasibility study,	OP1 OP2 OP3	GII-4.3			x	x							High	High	$209,000	$6,000	Implementation of the measures identified at diagnostic phase (Ex: inverters, solar panels, HMI adaption)
GII-4.5	Extend the existing SCADA to the other installations of BMLWE following the feasibility study, Update the O&M manual	OP1 OP2 OP3					x	x	x	x	x	x	x	Medium	Medium	$3,604,700		Engineering studies, programming, testing and commissioning of the SCADA, Supply and installation of instrumentation, Software Licence
SPECIFIC PROCESS IMPROVEMENT																$1,620,000	$670,000	
SPI-1	**Support for Customer management/ internal process**															$180,000	$530,000	
SPI-1.1	Migrate current Customer database form Billing and Collection system (EBML subscription management system) to the ERP Train commercial staff to ERP use	CR2 SA1	GII-1.5 SF-1.4 SF-1.5	x										High	High	$15,000	-	Data migration & technical support in case of issue

Action code	Action description	Related Maturity Grid Objective	Prerequisites	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	Priority	Complexity	CAPEx**	OPEx	Description
SPI-1.2	Implement eSignature for new contract management	CR1 CR2	GII-1.5 SPI-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	SPI-1.1 SF-1.4 SF-3.2			x								Low	Medium	$1,500	-	Mainly performed by Internal staff + external support
SPI-1.4	Implement mobile application for on-the-field customer information reporting (See project CRP1 in the other WEs)	CR1 CR2	SPI-1.1 SF-1.4 SF-1.5	x	x									High	High	$42,000	$12,740	Purchase of tablets & software (ex Kizeo) Software development to link to the ERP
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	SPI-1.4 SF-1.4 SF-1.5	x	x	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	SPI-1.1 SF-1.4 SF-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	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	Priority	Complexity	CAPEx**	OPEx	Description
SPI-1.8	Assess the feasibility of automatic data flow between the CRM (Cisco agent) and the ERP (for complaints registration in customer profile)	SA3 CR3	GII-1.5			x								Medium	Medium	$5,000	-	Consultancy (assessment)
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**															$80,000	$10,000	
SPI-2.1	Streamline communication channels via Customer Service Portal (website, mobile application)	CR3 CR4	SF-1.4			x								Low	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	GII-1.2 GII-1.5			x	x							Medium	Medium	$54,400	$5,440	Technical assistance to develop additional modules (interactive interface, integrations, etc)
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			x	x	x						Medium	Low	$22,500	-	SOPs development + Training
SPI-3	**Billing management**															$30,000	$0	
SPI-3.1	Create SOP to streamline billing and train staff	GOV2 CR3	SF-1.4 SPI-1.1	x	x									High	Low	$22,500	-	SOPs development + Training

Action code	Action description	Related Maturity Grid Objective	Prerequisites	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	Priority	Complexity	CAPEx**	OPEx	Description
SPI-3.2	Implement a dashboard to support debt management (late payers, unpaid amount, X months overdue, etc.)	GOV4 CR2	SF-1.4 GII-1.3 GII-1.5 SPI-1.1 SPI-3.1		x									High	Medium	-	-	Included in GII-3.2
SPI-4	**Collection management**															$70,000	$10,000	
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-1.5 SPI-1.1		x									Medium	High	$36,000	$2,000	Procurement of mobile printers Software development to link to the ERP
SPI-4.4	Reactivate the e-payment functionality on EBLM mobile app and website	CR3 SA2	SPI-2.1 SPI-2.2		x									High	Low	-	-	Performed by internal staff
SPI-4.6	Maximise the use of the e-payment through communication campaigns	CR3 CR4	SPI-4.4		x	x								Medium	Low	$3,000	-	Mainly performed by Internal staff + external support
SPI-4.8	Streamline cash collection procedures and train all commercial staff to the new tools and procedures	CR2 CR3 GOV2	SPI-1.1 SPI-4.2 SPI-4.4		x									High	Medium	$22,500	-	SOPs development + Training
SPI-5	**Metering management**															$560,000	$10,000	
SPI-5.1	Develop a module to integrate remote meter reading data from current pilot projects into the customer database. *(SEURECA strongly advises not to extend the perimeter of pilot projects before consolidation of the current data chain)*	CR2 CR3 SA2	SPI-1.1	x	x									Medium	High	$46,000	-	Technical assistance to write the specification redaction & develop the module

Action code	Action description	Related Maturity Grid Objective	Prerequisites	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	Priority	Complexity	CAPEx**	OPEx	Description
SPI-5.2	Deploy customer water metering for large consumers	CR2 CR3 SA2	SF-1.4 SPI-5.1			x	x							Low	Medium	$500,000	$10,000	Technical assistance (water metering strategy redaction & deployment) Meter installation & data management Meter maintenance & renewal
SPI-5.4	Develop a meter fleet management database	SA2	SPI-1.1				x	x						Low	Low	$5,000	-	Technical assistance to development the database (basic on excel)
SPI-6	**Production management**															$30,000	$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**															$20,000	$0	
SPI-7.2	Install Energy measuring units for detailed energy monitoring linked to the SCADA	OP2	GII-4.4 GII-4.5				x	x	x					High	Low	-	-	Included in the SCADA implementation GII-4.4 & GII-4.5

Action code	Action description	Related Maturity Grid Objective	Prerequisites	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	Priority	Complexity	CAPEx**	OPEx	Description
SPI-7.4	Develop energy consumption monitoring (energy efficiency KPIs) and management in line with the new SCADA	OP2 GOV4	SPI-7.2				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					Medium	Low	$15,000		Training
SPI-8	**NRW Management**															$90,000	$10,000	
SPI-8.1	Consolidate water production and consumption data to calculate NRW KPIs (physical losses)	OP2 GOV4	GII-4.4 GII-4.5 SPI-5.1			x	x	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-1.5 SPI-1.1 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
SPI-9	**Water quality**															$40,000	$30,000	
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 &

Action code	Action description	Related Maturity Grid Objective	Prerequisites	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	Priority	Complexity	CAPEx**	OPEx	Description
																		development to link it to the ERP
SPI-10	**Asset management: Inventory management**															$220,000	$30,000	
SPI-10.1	Carry out an inventory of the current equipment, including SCADA related assets (cf. GII-4.1)	PS1	-	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
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

Action code	Action description	Related Maturity Grid Objective	Prerequisites	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	Priority	Complexity	CAPEx**	OPEx	Description
SPI-11	**Asset management: Corrective maintenance**															$40,000	$10,000	
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 WM4	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
SPI-12	**Asset management: Preventive Maintenance**															$150,000	$0	
SPI-12.1	Configure basic preventive maintenance rules in the CMMS	WM1 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	SPI-11.1 SPI-12.1						x					Low	Medium	$22,500	-	SOPs development + Training
SPI-13	**ICT management**															$0	$0	

Action code	Action description	Related Maturity Grid Objective	Prerequisites	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	Priority	Complexity	CAPEx**	OPEx	Description
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-13.4	Create a 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	x									High	Low	-	-	Performed by internal staff
SPI-14	**Knowledge and HR management**															$40,000	$0	
SPI-14.2	Update Time attendance system to create a dataflow (attendance) to the ERP	HR1	GII-1.3 GII-1.5		x									Medium	Medium	$16,000	-	Technical support for software development
SPI-14.3	Improve ERP HR module (attendance and leaves monitoring, automatic issuing of payslips, training monitoring, etc.)	HR1 HR2	GII-1.3 GII-1.5			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**															$40,000	$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-1.5					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-1.3 GII-1.5			x								Low	Medium	-	-	Included in GII-1.4/1.5

Action code	Action description	Related Maturity Grid Objective	Prerequisites	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	Priority	Complexity	CAPEx**	OPEx	Description
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**															$30,000	$0	
SPI-17.2	Implement reporting procedures between operations and finance for assets condition financial recognition	PS3	SPI-10.7				x	X						Low	High	$22,500	-	SOPs development + Training
SPI-18	**Technical Project Management**															$0	$30,000	
SPI-18.1	Update Autocad (and other design software if required) licence	-	-		x									Medium	Low	-	$26,700	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 BMLWE action plan implementation are up to **7,200 k$,** which represents around 12% of its yearly turnover (collection). The **yearly additional OPEX** associated with the implementation of the action suggested are up to **910 k$** (in 2029, considering that all actions have been implemented); which represents (regardless the impact of the change rate) an **increase of about 2% of the current yearly OPEX** of BMLWE (51.9 M$ in 2020)[5].

The graph below shows the evolution of CAPEX over the next 10 years, detailing the amount for each category of action. The curve illustrates the percentage of initial budget execution year after year.
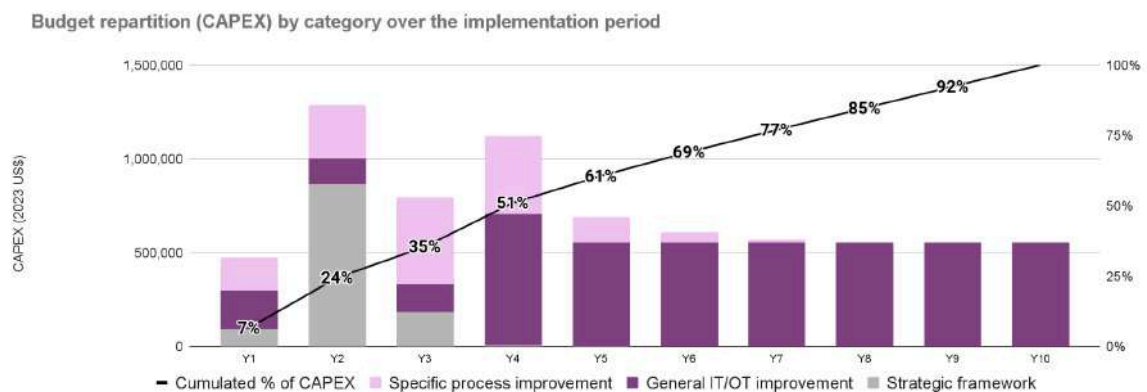

Figure 47: Investments repartition over the implementation period

The budget execution is quite regular over the 10 years. In 2025, it is expected that only 7% of the budget will be used: in fact, SEURECA anticipates a **relatively slow implementation of the action plan over the next year** (due to BMLWE decision, mobilisation of donors and contractors), then an acceleration in the following years.

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 BMLWE;*
- *the implementation of a LIMS;*
- *The implementation of additional modules to the ERP (and the related training & procedures updates): HR, tender database, procurement module.*

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[5] BMLWE Achievements and Future Plans presented by DG Jean Gebran - May 2021

The main sources of expenses are used to:

- **Fill the large gap identified in the operation management** thanks to:

  - The extension of the SCADA to all BMLWE'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 **35% of the total investments** and the **purchase of hardware and software** which represents **65% of the total investments**.

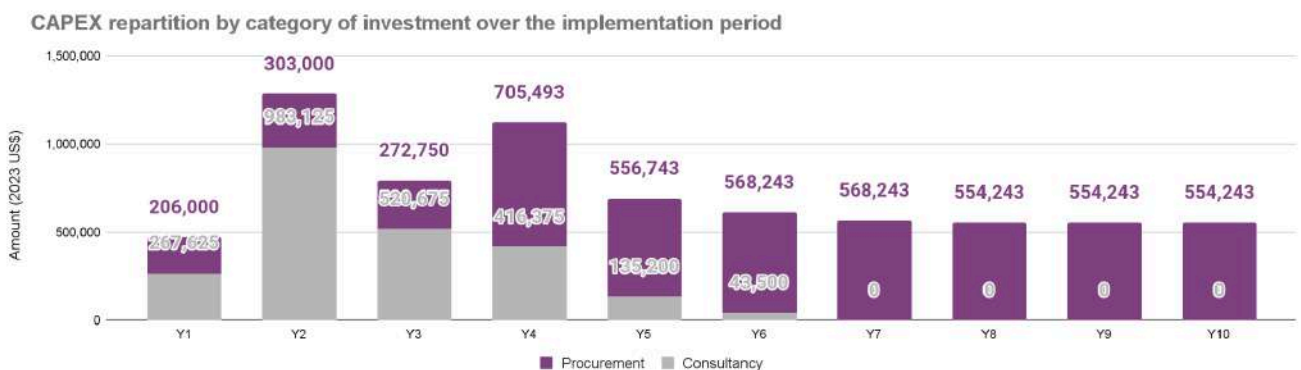Figure 48: Investments repartition regarding the category over the implementation period

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	🟨	🟥	Medium	Put in place monitoring and reporting processes to demonstrate compliance to the relevant regulatory authorities.

Table 10: Risk matrix and mitigation measures

4.4.2. SUCCESS FACTORS

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.

Year 1	Year 2	Year 3	Year 4	Year 5
CAPEX: 474 k$ OPEX: 66 k$	CAPEX: 1,286 k$ OPEX: 590 k$	CAPEX: 872 k$ OPEX: 853 k$	CAPEX: 2,549 k$ OPEX: 885 k$	CAPEX: 2,030 k$ OPEX: 907 k$

Strategic Framework implementation

- Implementation of an accurate organisation for digital transformation
- Strengthening of ICT department & Infrastructure
- Structuration of SCADA team & strategy
- Implementation of continuous improvement

General IT improvement

- General improvement of the ERP
- Performance monitoring system implementation
- SCADA infrastructure improvement

Specific process improvement

- Commercial operations improvement (customer regularisation, billing, customer journey, revenue collection)
- Customer metering implementation (integration of pilot project & focus on large customers)
- Implementation of volume management (production and NRW)
- Implementation of energy management
- Implementation of water quality management (LIMS)
- Implementation of assets management & work management (CMMS, GIS, Assets database)
- Strengthening of support services (HR, Accounting, Procurement)
- Strengthening of ICT management (helpdesk, TeamViewer, etc.)

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 BMLWE's digital transformation, SEURECA recommends to start by implementing the following measures:

- A technical assistance to carry out the overall re-organisation of BMLWE (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), 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 BMLWE's needs**, SEURECA recommends to start by implementing the following measures:

- A detailed assessment 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);
- A feasibility study to bring the SCADA back into service (GII-4.3) to issue the technical specifications for further contracting of external support.

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, water quality, (SPI-9.1, SPI-6.1);
- 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);

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:

- The migration of the current EBLM subscribers management software to the ERP (SPI-1.1) - This is the main priority for BMLWE regarding the improvement of its revenues (according to SEURECA understanding this is a project that the IT team is currently working on);

- The strengthening of commercial procedures and the provision of accurate digital tools, especially the ones related to customer information proper management and to billing to integrate current customer metering pilot projects (SPI-1.6,SPI-3.1,SPI-5.1).

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