SEURECA VEOLIA

Technical Assistance

Digital Transformation in Water Establishment - Focus on South Lebanon Water Establishment

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n°	Date	Comments	Author	Verified	Approved
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2	December 2023	Final report with diagnostic and action plan	L.BARGHEON	D.MILLION	F.LACOUR

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ACRONYMS

BCP	Business Continuity Plan
CEDRE	Conférence économique pour le développement, par les réformes et avec les entreprises
CIO	Chief Information Officer
CIM	Common Information Model
CMMS	Computerized maintenance management system
CPU	Control Process Unit
CRM	Customer relationship management
CRP	Customer Relationship Process
DCS	Distributed control system
EDL	Électricité du Liban
ERP	Enterprise resource planning
ETL	Extract Transform Load
GSM	Global System for Mobile
HMI	Human Machine Interface
HR	Human Resources
IioT	Industrial internet of things
IoT	Internet of Things
IT / OT	Information Technology / Operation Technology
ICT	Information and Communication Technology
ICS	Industrial Control System
IP	Internet Protocol
LIBNOR	Lebanese Standards Institution
LPWAN	Low-power wide-area network

MES	Manufacturing Execution System
NRW	Non-Revenue Water
OMT	Online Money Transfer
OPC-UA	Open Platform Communications Unified Architecture
PLC	Programmable Logic Controller
SCADA	Supervisory Control And Data Acquisition
SLWE	South Lebanon Water Establishment

EXECUTIVE SUMMARY

This document presents the outcomes of the **Diagnosis & Digital Maturity Assessment** and the **Action Plan** to meet the **Digital Transformation Roadmap** of the **South Lebanon Water Authority (SLWE)** which provides drinking water to more than **200 000 inhabitants.**

Diagnosis & Digital Maturity Assessment

While each SLWE's department was the subject of a dedicated diagnostic, the SWOT analysis (Figure 1 here after) presents a consolidated vision of the utility's current digital maturity.

On one hand, it shows that SLWE can rely on strong **governance** and **a clear strategic vision** (refer to appendix 5.4 "SLWE strategy 2020-2025") with a strong emphasis on Digital. SLWE has already initiated its digital transformation by implementing several digital tools **built around the accounting and financing ERP** with some of them considered very advanced particularly supporting operational processes (water quality, CMMS). This modernization has been facilitated by SLWE staff who have understood the benefits of digitalization. It has to be noted that SLWE is very **active on social networks** to communicate a more modern vision of a water utility and enhance the interaction with the customer.

On the other hand, SLWE **faces many challenges** on the organizational, technical and human levels. Due to the salary level in the public sector, **many skilled staff resigned** and it is more and more difficult to hire skilled professionals in a context of economic crisis. As a result, **SLWE lacks dedicated staff** for key projects or units (e.g. ICT unit) which impacts its ability to implement digital initiatives according to the strategy.

Additionally, insufficient financial resources prevent SLWE from **renewing digital tools licenses** (i.e. customer portal app and website) which directly impacts the commercial performance and the ability of the utility to collect the revenue.

SLWE aims at becoming a reference in the **operation performance** with full automatic control system (SCADA) and NRW platform but there is a **lack of instrumentation and control equipment** for the wells, reservoirs and transmission and distribution networks. **Without field data,** no control could be achieved and no operation performance could be tracked. **A dedicated assessment** has been made on the **current SCADA** showing that too many **uncoordinated projects** have been done without clear benedicts for SLWE but that the project considered by SLWE as the **SCADA Master plan** goes in the right direction but **will need to be improved** in order to gain the full benefits of a state of the art system.

Finally public regulations impose **complex document workflow** and there is no digital tool implemented to facilitate SLWE workflow and document management.

Strengths	Weaknesses
• **Digital governance** relying on a defined **SLWE overall strategy**, • **Overall motivation / Resilience**: During the interviews, the staff has shown high motivation to improve the current difficult situation and a clear appetite for digital, • Use of modules from the **same ERP** for most departments, • **Advanced digital tools** for maintenance (SEYANA) and water quality management (EIN), • Use of **social networks to communicate** with customers and provide general information to public, • **Knowledgeable studies department** managing the new projects (global water infrastructure, GIS database).	• Overall **lack of staff,** lack of skilled **dedicated staff for critical fields** such as IT security or SCADA, ERP programmer, • **No tool to track department or overall performance** (operation, customer affairs, administration), • **Lack of instruments and equipment to monitor and control** the water production and distribution, • No **Document Management System,** • No **documented process workflows,** • **Financial stress** preventing renewal software license fees, • Infrastructure **security to be strengthened**.
Opportunities	**Threats**
• **Support from donors:** Donors willing to finance projects but attention needed to identify the most relevant ones for SLWE performance improvement, • Legal acceptance of **E-Signature allowing projects to improve** customer document management, • No clear legislation regarding the use of Cloud solutions for the public sector making **possible the implementation of advanced tools hosted in the cloud.**	• IT/OT skilled staff level of salary not corresponding to **public sector salary levels,** • **Compliance with software license agreements** / Mis-use of license, • **Cyber attack on IT/OT systems.**

Figure 1: SLWE Overall SWOT

The digital maturity grid of the Figure 2 below presents the current digital maturity levels and the targeted maturity ones which have been defined with SLWE management.

The ultimate goal is to make SLWE a **self-sustaining enterprise** using the digital tools and a modern organization to ensure **efficient processes in the utility**. Through participatory discussions carried out with SEURECA, **SLWE management** sets very **ambitious targets** on every aspect of digitalization for the next 5 years. They range from advanced **operation management** and **high-end asset management** to a fully digitalized and integrated **performance management system**.

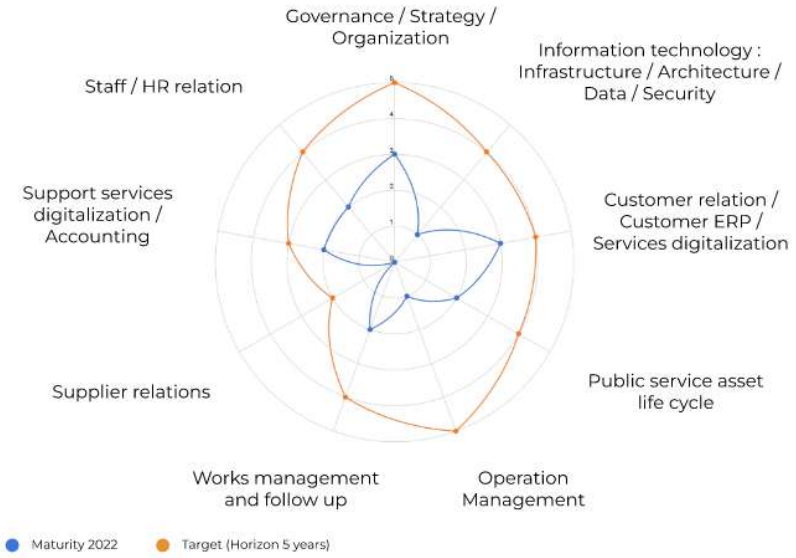


Figure 2: Digital maturity grid

Given the ambition, **the gap between the current situation and these goals** will require time, ressources and commitment to be bridged and the transformation roadmap, developed as part of this project, proposes a phased approach to initiate change, focusing on quick wins and priority areas.

Digital Transformation roadmap

Based on the initial assessment and the target state defined by SLWE's top management, a tailored **5-years action plan** was developed to guide the team on the various steps to be implemented to pursue its digital transformation journey. The approach adopted focused on i) strengthening the utility's institutional ability to implement the action plan ("Enabling Framework") and ii) proposing a prioritized sequence of action to develop the Digital Enterprise Transformation Platform (Appendix 5.5: SLWE Digital Enterprise transformation platform).

The figure below presents the summary of the updated SLWE Digital Transformation Platform roadmap with the different actions categories distributed according to the necessary timeframe and level of impact on the utility's financial performance.

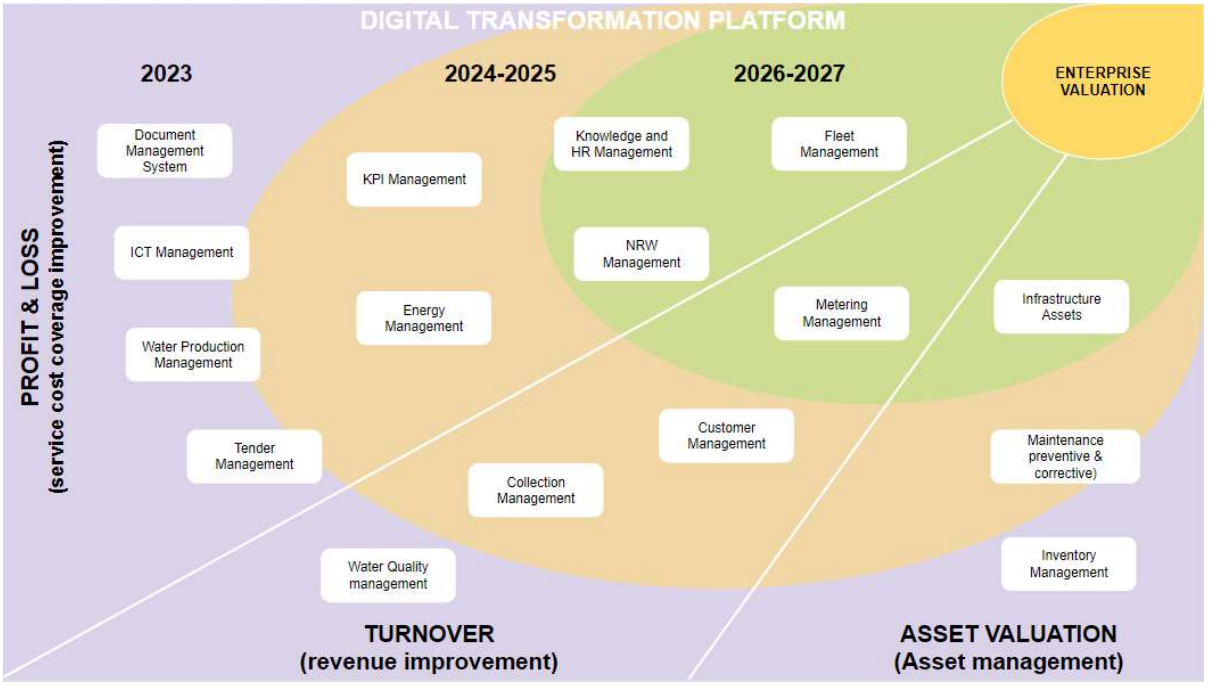


Figure 3: Updated SLWE Digital Transformation Platform roadmap

It should be noted that this Roadmap could not be implemented if the actions detailed in the "Enabling Framework" are not performed. They are prerequisites for the Roadmap actions and concur to the overall strengthening of the Establishment.

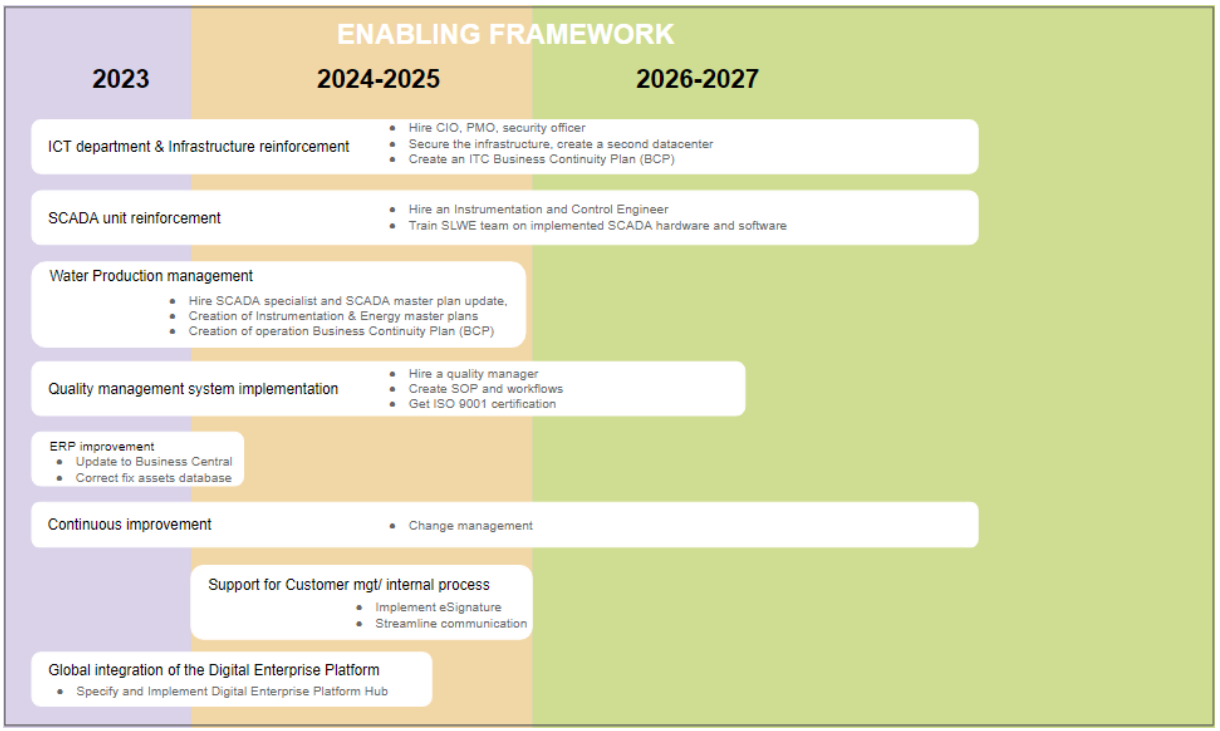


Figure 4: Enabling framework summary

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 (see figure below) in order to assist SLWE in initiating discussions with its financial partners.

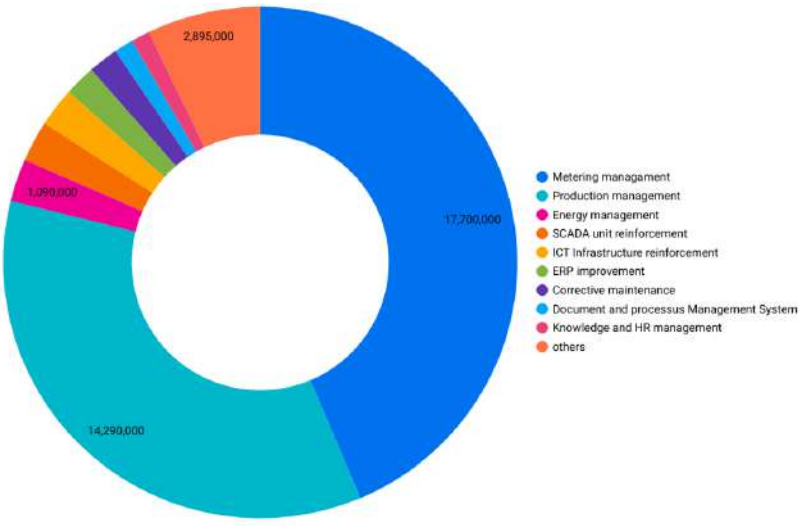


Figure 5: Repartition of the action budget (dollars, 2022 value)

The main source of expenses is used to fill the large gap identified in the operation management through a **massive investment in metering management and production management.** While the **production management** improvement, **via the extension of the SCADA** to the entire SLWE perimeter, was identified as a top priority, the metering management, aiming at reducing the Non Revenue Water, could be achieved at a later stage in 2026-2027.

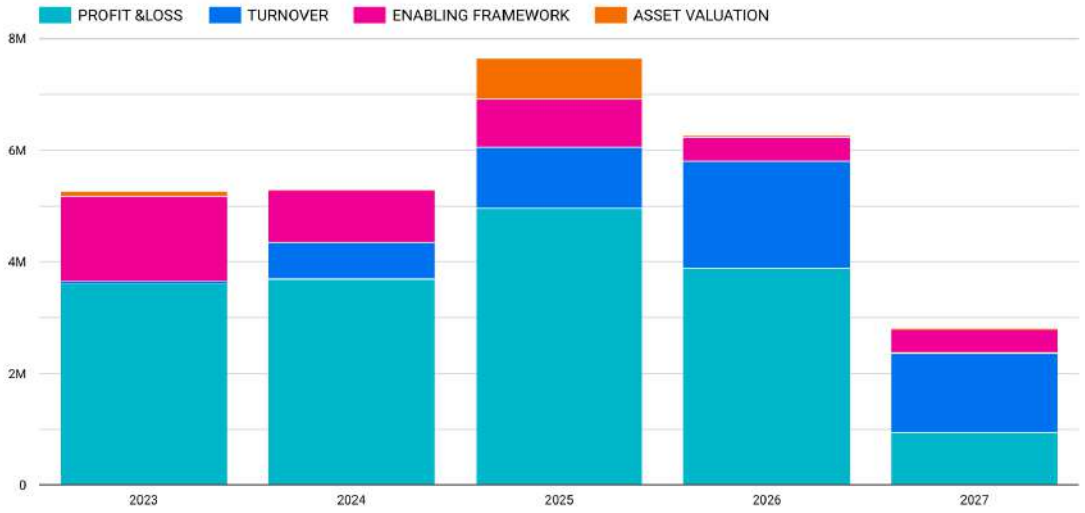


Figure 6: Budget repartition by roadmap action categories and enable framework (dollars, 2022 value)

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:

- **Hire & structure a dedicated team** (CIO, PMO, security officer, quality manager, etc..). It is essential to appoint a team dedicated to lead and be responsible for the implementation of this Roadmap (CIO, PMO, etc.) to guarantee the smooth running of the various actions, as well as support in the change management.
- **Strengthen cybersecurity** by performing a cybersecurity audit;
- **Improve the existing SCADA specifications** in order to launch a Call for tender;
- **Define the KPI monitoring platform specifications**;
- **Define the SLWE digital platform Hub specification**;
- **Upgrade the current ERP to Business Central**.

The support of a 2-3 years technical assistance project is also highly recommended moving forward to support SLWE 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 SLWE recruits its own experts;
- Knowledge transfer and organized capacity building;
- Support on preparation of technical specification and tendering processes that may be required for the implementation of the various activities;
- Etc.

1. INTRODUCTION

1.1. MISSION

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.

In this context, AFD intends to support the South Lebanon Water Establishment (SLWE) in **improving their operational performance through a Digital Enterprise Transformation program**. It will support the development process of the Water Establishment into a self-sustaining enterprise that is adequately financed via an adequate tariff structure based on optimized business, engineering, operations, management, and financial principles.

SEURECA has been selected to carry out the diagnosis and definition of the 5-years Digital transformation roadmap for the South Lebanon Water Establishment (SLWE).

The South Lebanon Water Establishment (SLWE) is divided in **7 branches** and its headquarter is located in Saida (refer to the Figure 3 below). It currently **operates the drinking water production and distribution network** of this perimeter and will soon have to operate several wastewater treatment plants.

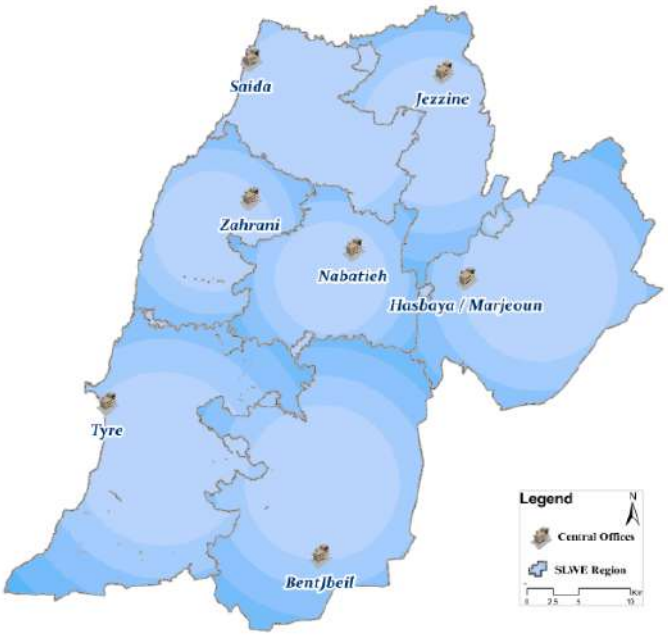


Figure 7: SWLE perimeter

1.2. OBJECTIVE

As part of the signed AFD framework contract for audit-diagnosis of water and wastewater services, SEURECA has therefore been tasked with the following objectives:

- Carrying out, in close coordination with the SLWE, a **diagnosis of the current digital maturity** of the various business areas;
- Carrying out, in particular, an **audit of the existing "Supervisory Control And Data Acquisition" (SCADA)**.
- Developing an **action plan for the modernization and digitalisation** of the Water Establishment's operations.

1.3. CONTEXT

"Lebanon has built its water sector on foundations laid down by successive civilizations such as Mesopotamia, the Roman Empire, and the Ottoman Empire. These empires have contributed much to the 'art' of water use and management in the region. Despite abundant rainfall, Lebanon's resources are only partly developed and its national demand for water is currently not being met from a water balance perspective. Only 17% of the country's water resources are used, while more than half its rainwater flows directly to the sea, barely tapped or used. On a national level, water that is unaccounted for due to system losses is about 40%; mostly due to the lack of maintenance of the water supply networks and illegal connections. Throughout the country, water resources are limited in terms of both quantity and quality as a result of mismanagement and an aging infrastructure resulting from inadequate investment (Oxfam 2017). The country endured 15 years of civil war and its water sector in terms of institutions, administration and infrastructure was left barely operational. It was not until the war ended in 1990 that fresh investment began in the sector as part of the post-war reconstruction efforts. Since then, Lebanon has invested more than $4 billion in the water sector. Its water and sanitation infrastructure, badly damaged by the civil war, was partially rehabilitated with substantial external financial assistance, most of which came as loans."

Extract from Challenges of post-war policy reforms in Lebanon's water sector - May 2022

"The CEDRE conference held in 2018 identified significant reforms in the water and wastewater sector as well as investments considered of the highest priority for the achievement of the targets set in the national strategy 2020-2030."

Extract from AFD page on Water Reform - January 2020

"But the country is currently faced with multiple shocks. In addition to the socioeconomic and financial crisis, the first effects of which were felt back in 2019, there are the consequences of the Covid-19 crisis and the explosion in the Port of Beirut on 4 August 2020, against a backdrop of political deadlock and tensions. This context requires an approach integrating short-term emergency issues while planning for the future. "

Extract from AFD page on Lebanon

South Lebanon Water Establishment (SLWE)

SLWE is one of the five Regional Water Establishments of Lebanon. These etablissements were **created in 2000 by regrouping local water utilities**. SLWE is the merging of Saida, Jezzine, Zahrani, Tyre, Bentjbeil, Nabatieh, and Hasbayay/Marjeoun which are now branches of SLWE.

SLWE faced numerous challenges over the years due to its geographical location close to the Lebanon Southern border (such as the overall unbilled water consumption linked to the refugee camps) and its particular hydrology requiring a water production relying mainly on deepth wells. Now with the current crisis, all water production means have been reduced due to the difficulties of electricity supply and impossibility to fully compensate with genset power due to fioul cost.

As described above, this mission comes at a time of social and economic crisis in Lebanon. The diagnosis must therefore be made through this prism, and the action plan must consider this crisis situation while building a stable foundation for its end.

Context on Digitalization

On the digital aspect, in 2018, a new SLWE director has been appointed putting the Digital Transformation at the heart of its new strategy.

A **Digital Transformation Roadmap has been prepared in 2019 by Evolusys**, a Information System consultant focusing on the ITC aspect of the establishment while recommending the implementation of an overall digital platform. This roadmap was based on SLWE key objectives listed below (refer to Appendix 5.4 "**SLWE STRATEGY 2020-2025**" for more details):

- **Consistent Water Supply**
  - Advance network monitoring and control
  - Monitor water flow
- **Drinking Water Quality**
  - Control of pollution
  - Monitor water quality
- **Cost Optimization**
  - Monitor operational parameters with better access and analysis
  - Control and operate remotely for better use of labor
  - Collect and record operation/status data for process improvement
  - Monitor NRW (Non-Revenue Water) through metering and SCADA control
  - Implement metering program (Installation of smart meters instead of gauges)
  - Develop a maintenance management system (MMS)
- **Customer Satisfaction**
  - Customer service
  - Call center
  - Customer interface (interactive platform, social media...)
  - Mobile application

Following the SLWE's 2020-2025 strategy, changes have been made in the organization with the creation of several departments or units such as the design department (including a SCADA unit and GIS unit) or the public relation unit. Many skilled staff were hired to work on new development projects. Unfortunately with the current social and economic crisis and the public salary level, many individuals have left the establishment and it is difficult to replace them.

This assignment is part of a digital transformation journey that has started in 2019. The work already done will be assessed and the roadmap realigned and complemented according to the current situation and the 5-years objectives.

1.4. Project Mobilized team

SEURECA mobilizes for the assignment the following team :

- Damien MILLION - Water Utility digital tools expert and team leader;
- François LACOUR - Utility transformation and capacity development Expert;
- Lucile BARGHEON - Digital Engineer;
- Alamjadh SALAMEH - Local Digital Expert.

2. METHODOLOGY

In order to achieve the objectives of this assessment while ensuring the consensus of all stakeholders on digital transition matters, SEURECA used its method developed internally around the following tools:

- Definition of the Digital Maturity Grid;
- Analysis of the digital customer journey (digital customer journey);
- Analysis of communication and exchange channels with customers (digital engagement channels);
- Strengths and weaknesses analysis (SWOT matrix).

2.1. FOUNDING PRINCIPLES OF CARRYING OUT THE MISSION

- The more information collected, the better the recommendations (adapted, precise)
- No judgment
- Participatory thinking and open discussion
- No right or wrong questions or answers

According to SEURECA's methodology, the diagnosis and action plan of a water/sanitation utility, with regards to digitalization roadmap definition, is organized in 3 main phases, regardless of its size, performance or scope:

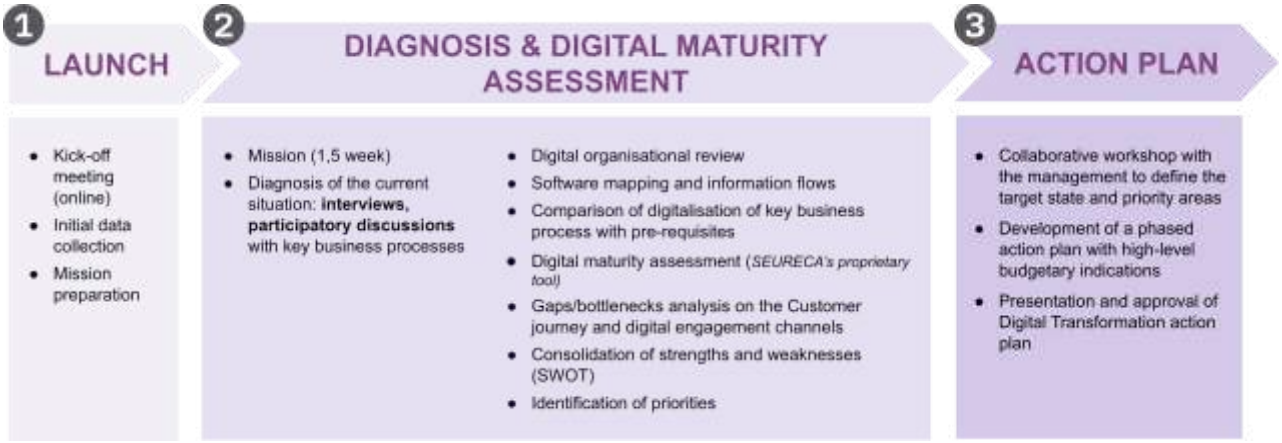


Figure 8: Methodology

2.2. Framing and launching

A **kick-off meeting was held on July 27, 2022** with AFD and SLWE to share the objectives and expectations of this mission. This meeting was also an opportunity to introduce the different stakeholders.

SEURECA presented in detail the approach, the methodology and schedule of the mission and the various restitution stages.

In addition, AFD and SLWE were able to share their vision in terms of modernization/digitalization, as well as the main opportunities and risks identified.

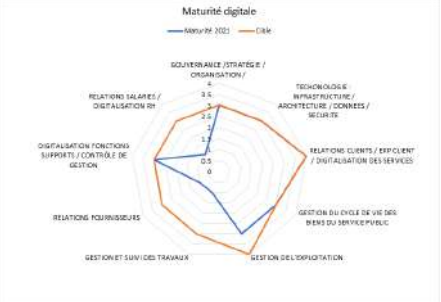
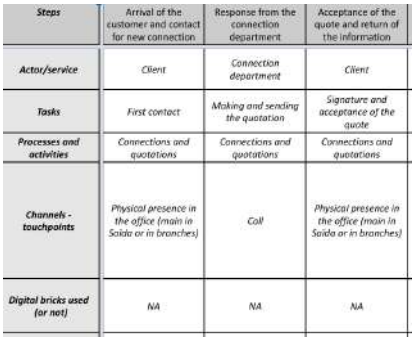
2.3. Diagnosis & Digital maturity assessment

The diagnostic covers the following business and corresponding tools:

Business	Tool
Management and administration	DMS : Document management system
	ERP : Enterprise Resource Planning
	Database
	LMS : Learning Management System
	Messaging tool
	Security system
	Projects follow up System
	Support tool (ticketing)
Customer and commercial	Customer relationship management
	DMS and communication
	Dematerialized customer journey: SMS, email, online agency, payment, claim, etc.
	Tele-metering and point of service
	Customer Relations Center (telephone)
Operations and assets Support	CMMS : Computerized maintenance management system
	SCADA : Supervisory Control And Data Acquisition
	Centralized control room (hypervision)
	GIS : Geographic Information System
	LIMS : Laboratory information management system
	Reporting tool
	EAM : Enterprise Asset Management

The diagnostic phase is based on a series of interviews. The list of people met is presented in the appendix section 5.2.

Tools and approaches described below were deployed during the diagnostic phase to help identify key issues.

Key components of the SEURECA's digital maturity assessment approach		Example - Illustration
1	**DIGITAL MATURITY GRID** Based on its experience of similar projects and practical lessons learnt from the Veolia Group, SEURECA developed its proprietary utility digital maturity grid which aims at assessing the organization's ability to deploy a digital transformation plan. As a cross-functional analysis of activities that impact the organization as a whole, the digital maturity analysis focuses on 3 transversal and strongly interrelated pillars: ● Strategy, organization and staffing: ○ Strategic vision; ○ Adequacy of the current organization and staffing; ● Processes, methods and tools: ○ Implementation of adequate processes related to the operation of a water utility (such as customer management, water production and distribution, water quality management) and underlying methods in line with best practices; ○ Use of adequate tools and systems (hardware and software); ○ industry standards benchmark; ● Capacity building: adequacy of the competencies and gaps. The grid displays the current maturity score compared to target goals defined with SLWE management.	
2	**CUSTOMER JOURNEY AND ENGAGEMENT CHANNELS** Customer management is at the heart of public service delivery and, often instigated at national level. This analysis aims at mapping the tools and engagement channels implemented to facilitate the customer experience. A gap analysis can enable the identification of immediate actions that can substantially improve the utility's operations including key processes such as customer registration, customer data regularization, billing, revenue collection, complaint management, etc.	

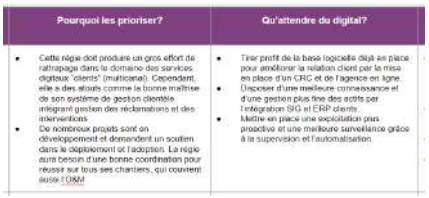
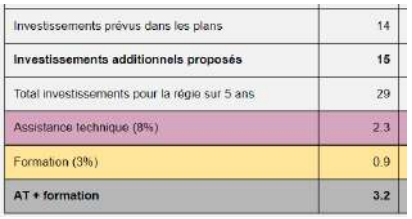
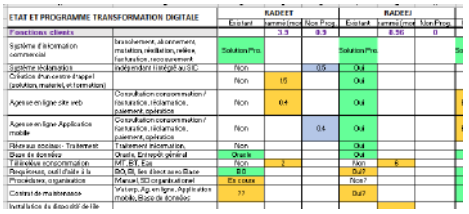
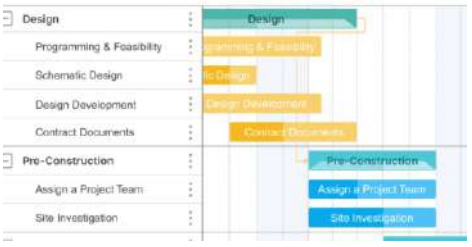
Steps	Arrival of the customer and contact for new connection	Response from the connection department	Acceptance of the quote and return of the information
Actor/service	Client	Connection department	Client
Tasks	First contact	Making and sending the quotation	Signature and acceptance of the quote
Processes and activities	Connections and quotations	Connections and quotations	Connections and quotations
Channels - touchpoints	Physical presence in the office (main in Saida or in branches)	Call	Physical presence in the office (main in Saida or in branches)
Digital bricks used (or not)	NA	NA	NA

3	**SWOT ANALYSIS** To provide a bird's eye view of the current situation, the elements gathered during the assessment are structured into a SWOT specifying the strengths, weaknesses, opportunities and threats relative to the digital transformation of the SLWE.	

2.4. Action Plan

The second phase of the assignment consists in the development of an action plan for the digital transformation of the establishment (next deliverable).

It will be done in the following steps:

	Key components of the SEURECA's action plan approach	Example - Illustration
1	**ACTION REGISTER** Recommendations identified during the diagnostic are **complemented with the actions required to reach the targeted state** and then organized according to their type (organizational, technic, etc..). Each action then receives a priority level.	
2	**CHANGE MANAGEMENT EVALUATION** The action register is complemented with the evaluation of the change management support for the deployment of the actions.	
3	**BUDGET ESTIMATION** Estimation of investment budgets to provide the necessary technological means to move from the current level of maturity to the envisaged target state.	
4	**PROPOSED TIMELINES** A timeline of the main actions is built for the next 5 years in order to reach the targeted state of each category of the Digital maturity grid.	

2.5. Our approach to digitalization

OPERATION AND BUSINESS PERFORMANCE

The intrinsic objectives of a water utility digitalization are to:

- Reduce non-value added tasks and eliminate errors;
- Streamline relationships between stakeholders, especially customers;
- Support decision making;
- Automate the conduct of operations and processes.

Ultimately digitalization is a means to **offer a better service to users, in terms of quality, quantity and price** and benefits to all water sector's stakeholders.

Using VEOLIA extensive experience as a water network operator combined with SEURECA recognized utilities improvement consulting capability, our approach to digitalization is to seek for the most relevant solutions given the digital maturity level and digital context of the country, aligned with the Establishment's ambitions. SEURECA ensures that each proposed digital recommendation is financially viable and will **improve the efficiency** of the related business area.

In its approach, SEURECA integrates digital sobriety as a key notion, which means not multiplying tools, servers and stored data, but rather ensuring that each of these elements has a purpose and delivers the maximal value.

While the technical side is usually well identified and budgeted, the **human factor** and the required new organizational governance and associate budget are often underestimated. It is however crucial **for a successful transformation.** More automated, more efficient digitalized processes require higher skilled technical experts that are usually harder to hire and retain.

3. Diagnosis of the current situation

3.1. Synthesis

This chapter is the overall synthesis of the diagnostics carried out on all the processes and corresponding digitals tools. The detailed diagnostic of each department and the focus on SCADA presenting the dedicated SWOT and recommendations are covered in the following chapters 3.2 and 3.3.

3.1.1. SLWE Digital tools

3.1.1.1. Tools per business

Business	Tool type	Current SLWE Digital tool
Management and administration	DMS : Document management system	No dedicated tool used, share drive on the virtual server for document sharing Customized **Dynamics Nav** Document Register module
	ERP : Enterprise Resource Planning	**Dynamics Nav** (Navision) with various customized modules
	Database	**Dynamics Nav** database for the ERP and modules,
	LMS : Learning Management System	No tool used
	Messaging tool	No tool used Whatsapp
	Security system	No tool used
	Projects follow up System	No tool used (possible use of **Crystal track** but this functionality has not been implemented)
	Support tool (ticketing)	**Crystal Track** but tool not used due to a lack of training
Customer and commercial	Customer relationship management	Customized **Dynamics Nav** CRM module
	DMS and communication	Communication via social networks (Facebook, Instagram, Twitter)
	Dematerialized customer journey: SMS, email, online agency,	Website (down since several months due to license issue)

	payment, claim, etc.	SLWE application (down since several months due to license issue) Email Whatsapp (from SLWE to the municipalties) Callcenter
	Tele-metering and point of service	**Diavaso Suite** but only at pilot stage for a jezzine city
	Customer Relations Center (telephone)	**Call Center** in Saida headquarter
Operations and assets Support	CMMS : Computerized maintenance management system	Inhouse customized **Dynamics Nav** module
	SCADA : Supervisory Control And Data Acquisition	**Factorytalk View** and Customized SCADA based on **Labview**, for fews wells and reservoirs, **PCVUE32** for a district meter monitoring pilot
	Centralized control room (hypervision)	No tool used yet
	GIS : Geographic Information System	**Arcgis ESRI Destop**
	LIMS : Laboratory information management system	Inhouse customized **Dynamics Nav** module including sampling process workflow called **EIN**
	Reporting tool	No dedicated tool used beside **Microsoft Excel**
	EAM : Enterprise Asset Management	Asset database in **Dynamics Nav**

3.1.1.2. TOOLS MAPPING

The figure below shows the tools distributed by the department with the exchanges between them. It was drawn up as a basis for comprehension, and to visually identify the possible interactions that might improve the overall integration.

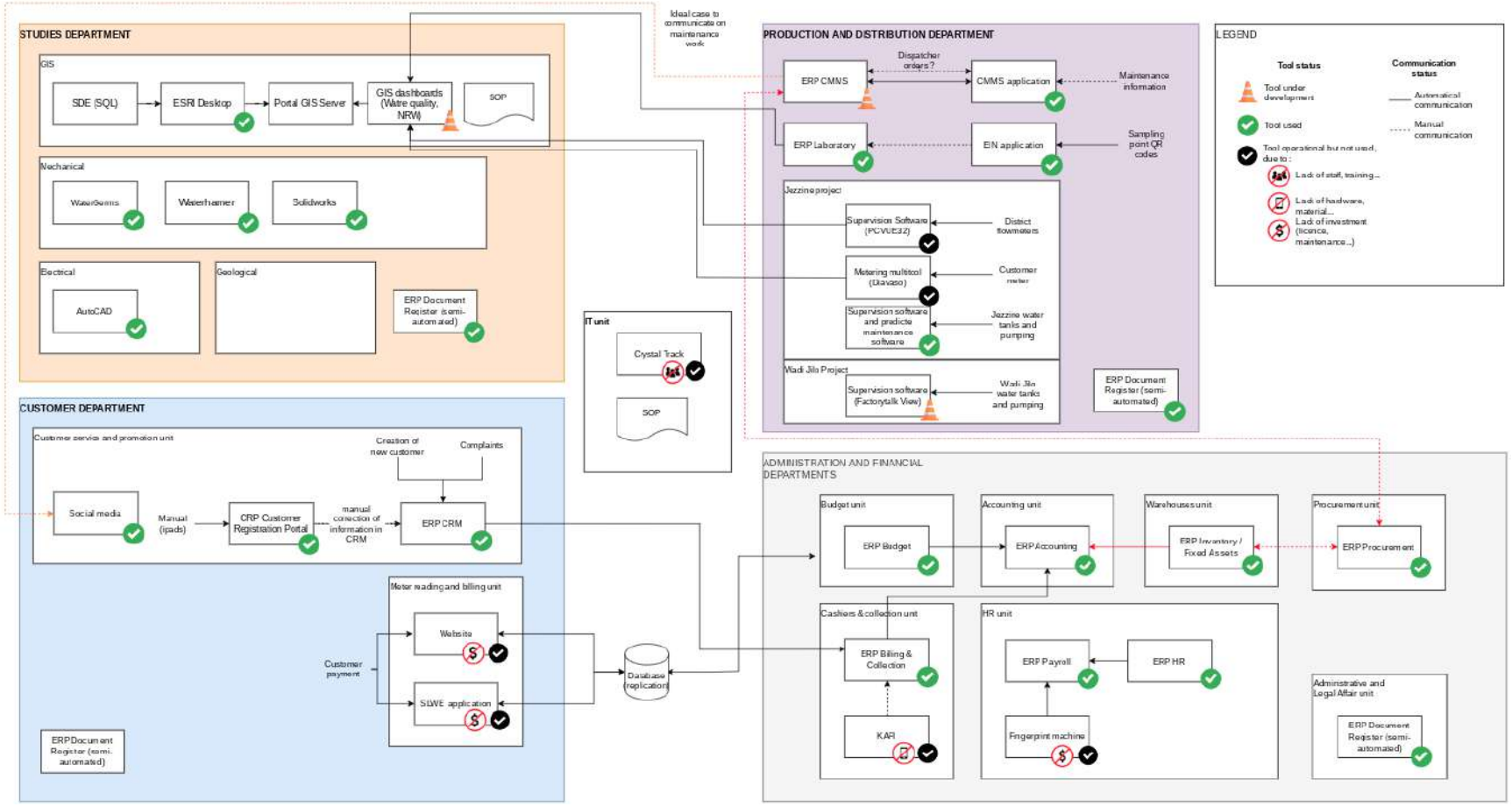


Figure 9: SLWE tools mapping

3.1.1.3. Overall SWOT

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
• **Digital governance** relying on a defined **SLWE overall strategy**, • **Overall motivation / Resilience**: During the interviews, the staff has shown high motivation to improve the current difficult situation and a clear appetite for digital, • Use of modules from the **same ERP** for most departments, • **Advanced digital tools** for maintenance (SEYANA) and water quality management (EIN), • Use of **social networks to communicate** with customers and provide general information to public, • **Knowledgeable studies department** managing the new projects (global water infrastructure, GIS database).	• Overall **lack of staff,** lack of skilled **dedicated staff for critical fields** such as IT security or SCADA, ERP programmer, • **No tool to track department or overall performance** (operation, customer affairs, administration), • **Lack of instruments and equipment to monitor and control** the water production and distribution, • No **Document Management System,** • No **documented process workflows,** • **Financial stress** preventing renewal software license fees, • Infrastructure **security to be strengthened**.
Opportunities	**Threats**
• **Support from donors:** Donors willing to finance projects but attention needed to identify the most relevant ones for SLWE performance improvement, • Legal acceptance of **E-Signature allowing projects to improve** customer document management, • No clear legislation regarding the use of Cloud solutions for the public sector making **possible the implementation of advanced tools hosted in the cloud.**	• IT/OT skilled staff level of salary not corresponding to **public sector salary levels,** • **Compliance with software license agreements** / Mis-use of license, • **Cyber attack on IT/OT systems.**

3.1.1.4. DIGITAL MATURITY

It 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 organization, 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

The current maturity is then **compared to the targeted maturity state of each business** defined in collaboration with SLWE during the mission.

SLWE management has set very **ambitious targets on every aspect of digitization** for the next 5 years. The ultimate goal is to make SLWE a self-sustaining enterprise using the digital tools and a modern organization to improve the various processes of the utilities by making them more automatic (less dependent on the human factor in times where staff is difficult to hire and retain) by tracking the financial and operation performances of the utility with detailed KPIs. The key components that SLWE has identified to achieve the targets were :Level - Expert

- GIS and CMMS to improve maintenance performance and asset life cycle,
- SCADA to allow automatic operation and remote monitoring and control,
- Financial and accounting ERP,
- KPI calculation,
- Electronic documentation management, digital workflow management
- Digital platform to integrate all the existing and future ERP modules.

The result of the Digital Maturity assessment is summarized below.

	Current maturity rating	Target maturity state *Horizon 5 years*
Governance / Strategy / Organization	**Level 3 - "Competent"** *The management is convinced of the impact of digital transformation on the quality of service and performance of the Establishment. It is adapting the organization and recruiting the right people. It has a clear vision of the holistic implementation of the digital transformation project and a coherent*	**Level 5 - "Expert"** *The management system and internal procedures are completely dematerialised. An employee collaborative space has been set up with electronic document management. All staff are aware of and involved in the digital transformation of the company.*

	Current maturity rating	Target maturity state *Horizon 5 years*
	roadmap and action plan.	*The front-office platforms are linked to the management system (internal/external workflow). The company is ISO9001 certified. Performance indicators are FULLY produced automatically. Management reports are produced quarterly.*
Technology : Infrastructure / Architecture / Data / Security	**Level 1 - "Aware"** *The IT development plan follows the recommendations of the master plan, the IT infrastructure is well dimensioned and the outsourcing system in place satisfies users (no interruptions).*	**Level 4 - "Advanced"** *Security architecture and policies are documented and fully implemented. Databases are managed, including security and performance.* *Documented Business Continuity Plan for critical applications. Managed services interventions are tracked through an intervention management platform. Some preventive maintenance tasks are performed, such as firewall updates, software or operating system version management.*
Customer Relation / ERP / Services digitalisation	**Level 3 - "Competent"** *The Customer relationship management is integrated with a maintenance contract and version updates. Each customer service representative in the sales office is multi-skilled and can handle any type of operation and can record complaints with an application integrated and centralized in the CRM. Complaints are traced regardless of the channel used and connected to the intervention management system. Possibility to measure intervention times. The Establishment is active on social media and communicates.*	**Level 4 - "Advanced"** *The Customer relationship management is integrated with a maintenance contract and version updates. Each customer service representative in the sales office is multi-skilled and can handle any type of operation (multi-skilled) and can record complaints with an application integrated and centralized in the CRM. Complaints are traced regardless of the channel used and connected to the intervention management system. Possibility to measure intervention times.* *The customer can also carry out any type of operation from an online agency or mobile application. The process of handling requests is dematerialised within the Establishment. The Establishment is active on social media and communicates any operation event.*
Public service / Asset life cycle	**Level 2 - "Development"** *The equipment & network asset database (GIS) is permanently updated on a platform linked to the "fixed assets" accounting system - Curative and preventive maintenance operations are not exhaustive.*	**Level 4 - "Advanced"** *The equipment and network asset databases (GIS) are updated on a permanent basis on a platform linked to "fixed asset" accounting and coupled with a CMMS with exhaustive monitoring of curative and preventive maintenance operations and permanent updating of reinforcement, renewal and extension requirements via permanent modeling of the networks with integration of anomalies (leaks, pressure, blockages, overflows, flooding, etc.)*

	Current maturity rating	Target maturity state *Horizon 5 years*
Operation Management	**Level 1 - "Aware"** *Existence of an incomplete telemetry system.*	**Level 5 - "Expert"** *Existence of a multi-trade remote management system with monitoring of alarms, measurements, remote control operations based on predictive scenarios, daily use of decision-making tools (conditional maintenance, prioritization of maintenance interventions, improvement of yields) coupled with the monitoring of consumption by the hydraulic sector. Business continuity plan and economic optimisation of operating costs (energy, pumping, overflow, etc.)*
Works Management and Follow Up	**Level 2 - "Development"** *Existence of an internal works monitoring tool with exhaustive traceability of works with start dates, monitoring of attachments, disbursements, recording of reports and test reports, photo reports.*	**Level 4 - "Advanced"** *Existence of a permanent geospatial platform for monitoring works with start-up dates, monitoring attachments, disbursements, recording of reports and test reports, photo reports. Systematic integration into the equipment and GIS asset database with attributes relating to the contract reference, date of work and company details and systematic removal of replaced works and equipment (physical and asset database).* *Customers can be informed of water cuts, via the Establishment's website and social networks.*
Supplier Relation	**Level 0 - "Innocent"** *All transactions with suppliers are carried out by mail, fax and paper documents.*	**Level 2 - "Development"** *All transactions with suppliers are carried out by mail, fax and paper documents. Posting of tender notices on the website via the supplier platform, downloading of tender notices and communication of judgment stages. Internal tender 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 commercial information systems, the asset database and the purchase requests of the various departments.*	**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.*

	Current maturity rating	Target maturity state *Horizon 5 years*
Staff / HR digitalisation	**Level 2 - "Development"** *The dematerialisation of internal procedures enables exchanges via a digital workflow.* *Working time management: Time sheet / working time monitoring to facilitate the transmission of payroll data, absences, holidays, work accidents, with intermediate declaration and validation, linked to the payroll software for the production of pay slips.*	**Level 4 - "Advanced"** *The dematerialisation of internal procedures enables exchanges via a digital workflow* *Working time management: Time sheet / working time monitoring 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* *Social balance sheets, CSR statistics, production of performance indicators, digitalized individual interviews, e-learning and skills and knowledge management.*

Nota: During the mission, the draft of the current assessments have been presented to the management to be discussed and challenged. It has been used as a basis of discussion to set the targeted maturity level.

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.

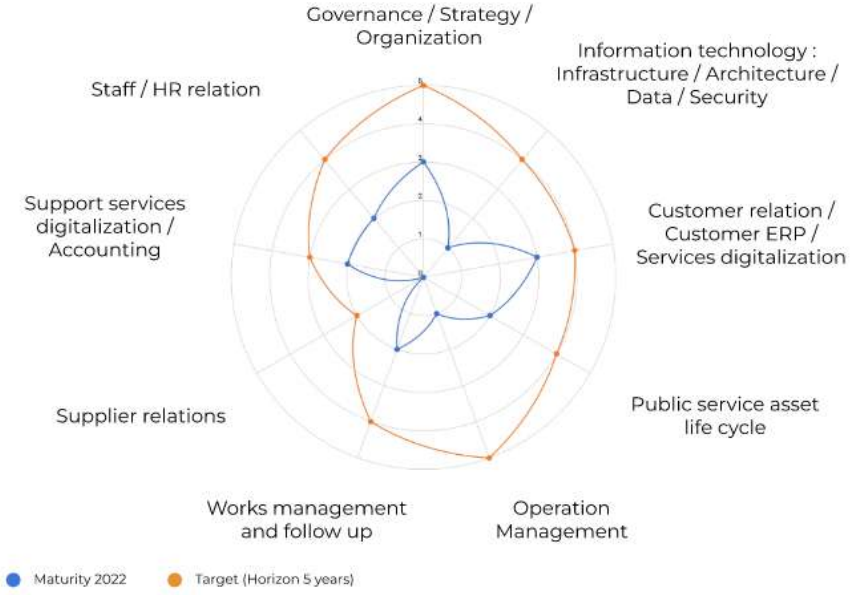


Figure 10: Consolidated maturity grid

3.2. Diagnosis by department & unit

This chapter covers the diagnostic of following departments:

- Central administration department including the ITC unit,
- Accounting and financial affairs,
- Operation departments:
  - Production and transmission department,
  - Distribution department,
- Study and project department.

Nota: the recommendations made during this diagnostic will be grouped, complemented and prioritized in the action plan.

3.2.1. Information communications technology (ICT) unit

3.2.1.1. Mandate

The ICT department provides technology and communications-related services and support for SLWE to achieve its goals and objectives. It has three key functions:

- **Implement and apply the ICT governance** for the ICT systems, architecture, and networks;
- **Manage the hardware components and the network Infrastructure**;
- **Create and maintain operational applications**; develog, secure, and store electronic data and assist in the use of software and data management to all functional areas of the utility.

3.2.1.2. Organization

The ICT Unit is part of the Central Administration department. It is organized as shown below:

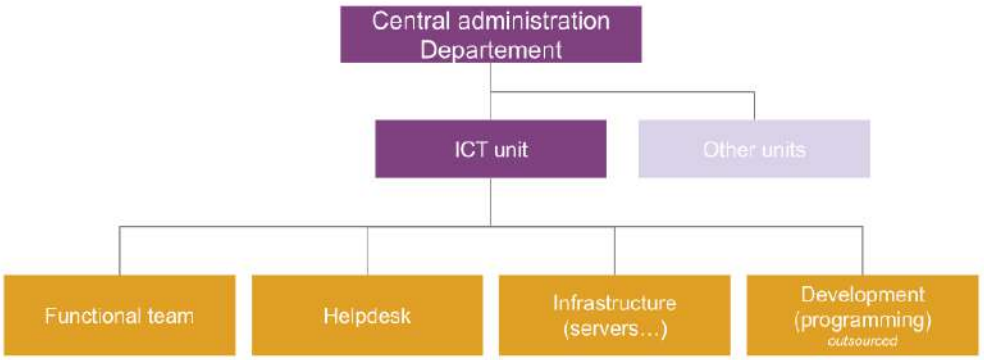


Figure 11: ICT unit organization

The team is composed of :

- Functional team: 2 technicians
- Helpdesk team: 1 of the functional technicians
- Infrastructure: 1 engineer
- Development team: 1 part time engineer (outsourced paid by Donors)

Currently there is no Chief Information Officer (CIO), nor a Chief Information Security Officer (CISO) and no Security dedicated staff. A Digital Transformation Manager has been appointed under the direct management of the SLWE Director.

Nota: Due to the current economic crisis, they have lost almost half of the team (4 employees resigned) including a programmer who was a key staff member.

3.2.1.3. Processes

The scope of the ICT team covers several processes, such as :

- **Maintenance** of all desktops, servers, storage and network equipment and all peripherals, the setting up of user accounts (and installation of system software - ie Microsoft Office products); SLWE IT inventory counts more than 260 desktops.
- **Administration** of the network infrastructure (WAN and LANs), including the verification that transmission links are functioning correctly and are **secure and reliable**;
- **Administration and maintenance** of the digital tools databases;
- **Management of the warranty and support contracts;**
- **Daily backup** of all databases, systems, and network equipment;
- **Business Continuity:** with the verification of the availability of databases and the continuity of all network, equipment, applications and of the existing data center, the raise of any risks, issues, or problems encountered during backups with suggested solutions;
- **Disaster Recovery:** with the verification of the availability of the databases and the continuity of all network equipment and applications during disasters, the verification of the availability of the Disaster Recovery Data Center in different location, the raise of any risks, issues, or problems encountered during backups with suggested solutions, the periodical simulation of the Disaster Recovery to ensure the effectiveness of the Disaster Recovery procedure;
- **Existing business process improvement** by identification, designing and implementing new applications or enhancing existing ones.
- **User support** including logging, qualifying and resolution of user requests (various issues, access right request). Within SLWE, 245 users have access to the ERP.

The ICT unit has **SOPs made by Evolusys,** a consultant that also produced the 2019 “Digital Transformation Roadmap”. They cover the following topics:

- Global planning;
- Global Control and Monitoring;
- Requirements Management;
- Projects testing and implementation;
- Project planning;
- Project monitoring and control;
- User support;
- Application maintenance;
- Infrastructure management;
- Configuration management;
- Products and processes Quality Assurance.

The content of these SOPs were not evaluated as they were all in Arabic.

Nota : It has been declared that these SOP are not completely followed by the department due the shortage of staff.

3.2.1.4. ICT UNIT DIGITAL PROJECTS IN PROGRESS

ERP related projects are under the ICT unit management and several modules have been developed over the years for various businesses (e.g water quality), the current projects are the following :

Tools	Description	Status	Comment
ERP - CMMS	CMMS with state of art functionality programmed as a extension module of Navision	In progress	Only deployed on demo environnement
ERP - Various modules	Continuous improvement of Finance, CRM, Water Quality modules	In progress	

Nota: Digital tools projects led by the study department on GIS and SCADA don't appear here as IT is supporting them but is not directly responsible for them.

Since 2015, the IT team has been involved in the Microsoft Navision ERP to customize it according to the needs.They can develop their own module with their development license.

3.2.1.5. TOOLS USED

The tool used by the department is described below:

Tools	Use	Comment
Crystal Track	IT Helpdesk for user support	A first implementation has been done for the IT Helpdesk in 2021 (ticket workflow, user definition, etc..) It is operational but no one is using it on a daily basis (the staff members who were trained left). Note that the maintenance has not been paid.

3.2.1.6. SWOT

The interview with the head of department/unit and the analysis of the existing situation resulted in the SWOT matrix below:

Strengths	Weaknesses
• Use modules of the same ERP for most departments, • Existence of SOPs, • Use of **virtual machines** saving on hardware and maintenance costs,	• **Lack of staff at all level**s; not enough IT technician/engineer, No Chief Information Officer,

• Nomination of a **Digital Transformation Manager.**	• **Lack of inhouse security skill** (no security officer or Chief Information Security Officer (CISO), • **ERP Development limited** by discontinued programmer present (following Donor funds), • User support, disaster recovery and business continuity management, • **Combined IT/OT infrastructure**, • Difficulty to **pay software license fees**.
Opportunities	**Threats**
• No clear legislation regarding the **use of Cloud solutions** for the public sector.	• **Public sector salary levels** not corresponding to ICT salary ones, • Overall infrastructure **relying of the reliability of public and private communication sector** which have business continuity issues, • **Cyber attack on IT/OT systems**.

3.2.1.7. Recommendations

Organization

The 2019 "Digital Transformation Roadmap" was oriented toward the ICT department and the improvement that should be put in place to greatly improve the performance of the department and supporting and securing the digital transformation of the establishment. Unfortunately due to various circonstances, not all the recommendations of this roadmap have been implemented or maintained (e.g. helpdesk process, project management process, specialized staff hiring, etc.). **SEURECA considers that it is key to continue implementing these recommendations, and to reinforce the security of the system (see focus on Cybersecurity below).** Hiring a Security officer(s) or getting external support on this topic should be a top priority.

Infrastructure security

Focus on the overall cybersecurity

The water sector is becoming more and more the target of cyber attacks worldwide due to its criticality in terms of public health.

In a context of SLWE digital transformation, security is more than critical. Currently the infrastructure of the IT and the OT seems combined (SCADA server virtualized on IT server) which is not recommended.

There are only two firewalls located in establishment headquarters in Saida. Adding a firewall per branch will increase the security of the system. **We recommend conducting a cybersecurity audit on the IT system**. Below is an example of application of a typical in

Defense-in-depth security architecture that Veolia uses to secure its installations.

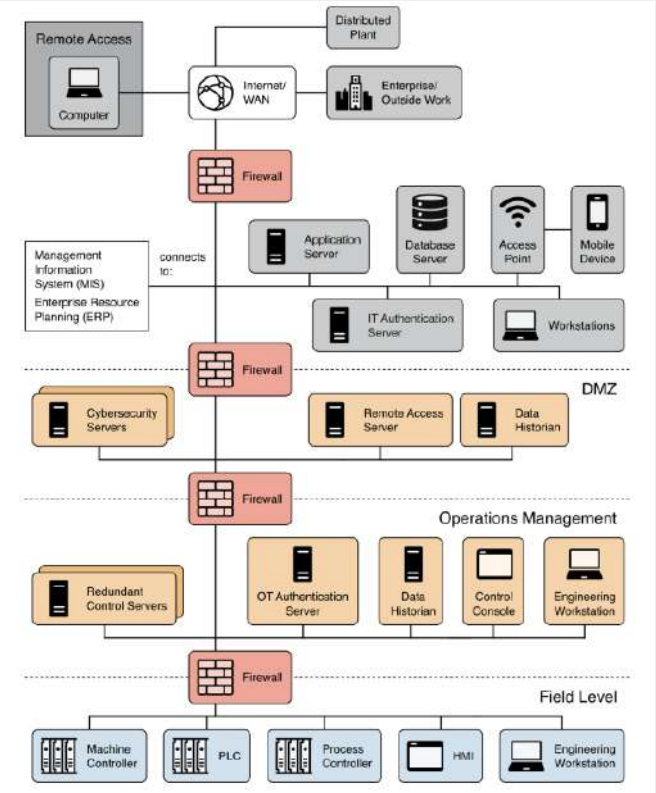


Figure 12: Defense-in-depth security architecture example

Software

Most of the tools developed to meet SLWE business needs are based on the **ERP Microsoft Dynamics Nav (Navision)**. Using the ERP as the backbone of the entire software architecture is very relevant as it allows the development of customized modules for the different departments and units as well as the centralization of data. SEURECA strongly advises SLWE to maintain and strengthen this existing structure.

While the unified approach constitutes a real strength, Navision has a new version called **Dynamics 365 Business Central.** We recommend **migrating as soon as possible to the new version** as it brings major improvements in terms of user interface, communication with other software. It is easier to customize which will greatly help in the constant ERP modules improvement and lack of programmer support. Dynamics 365 Business Central offers the option of switching to a cloud based approach which is a relevant long-term solution to secure data and remote access to the ERP.

3.2.2. Operation departments

3.2.2.1. Mandate

The purpose of the Operation department is to provide sufficient quality water to its customers according to customer bylaw and service level agreements. Digital supports this department by providing relevant tools to monitor production, distribution, water quality, maintenance and performances.

Water production in SLWE

There are 25 stations that produce 80% of the water. Main stations produce on average 250 000 m3/day and usually provide water for 2 different branches.

There are about 370 wells on the network. They are around 300 meters deep (some can be deeper than 500 meters). However this number is in constant increase as there is a lot of donation from the municipalities or private to add new wells (around 1 per month). Note that the production of the wells is complexe to analyze due to the difficulty to know how many hours they are operated.

3.2.2.2. Organization

The operation department is divided into two main departments: the operation department and the distribution department. Each department has around 450 employees that are mostly handling both roles in the small villages. The production department is in charge of the different pumping stations, treatment stations, wells etc. The distribution department is responsible for the water network.

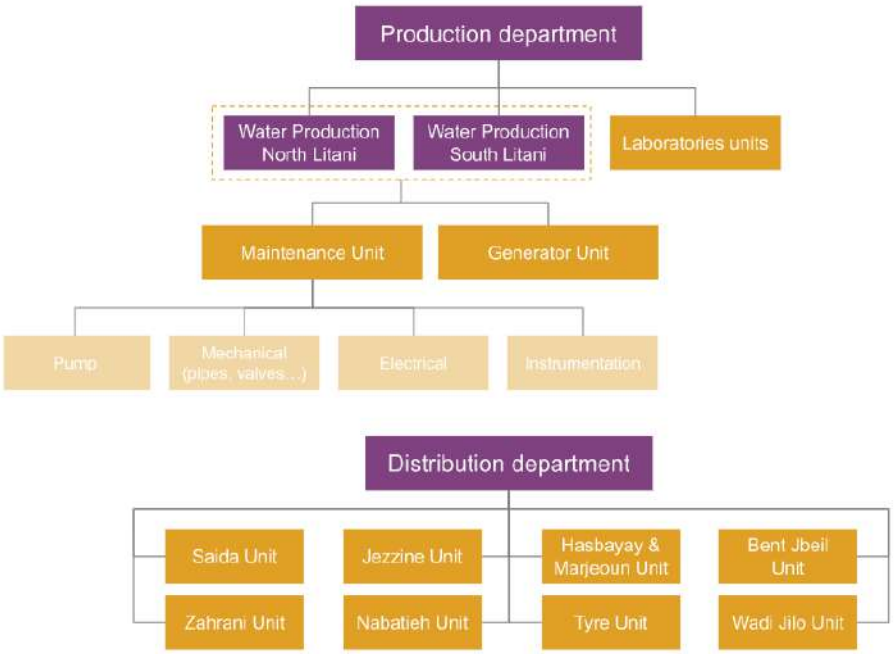


Figure 13: Operation department organization

The maintenance and generator units are responsible for **corrective and preventive maintenance of the assets and the generator running and maintenance**. The maintenance unit is composed of 9 maintenance staff divided in 4 disciplines: Pump, Mechanical (piping), Instruments and Electromechanical. There is a maintenance workshop based in Tyre city with 2 members of the maintenance unit. The generator unit is composed of 4 technicians.

As for the water quality unit, it is responsible for **collecting and analyzing water samples in their lab and communicating the results**. The unit relies on the LIBNOR standard, allowing to define the location and frequency of sampling. The Laboratory unit has its main laboratory in Saida . Five secondary laboratories are disseminated in the branches (Tebnine, Tyre, Nabatieh, Taybeh and Jezzine) and 1 water sampling technician per lab except for Saida where there are 2 of them.

3.2.2.3. Processes

Operation and Distribution

The on-site operator duty is to **start and stop the well pumps and the associated generator** if the installation is not connected to EDL (Electricity of Lebanon). He is also in charge of the **valve management to distribute the water by area** (no real monitoring). The Customer Relation department can also contact the on-site operator to **open new subscribers (or close)** by setting up gauges (system to limit the flow to 1m3/day).

He reports all operational information to the production engineer in charge of the branch via **WhatsApp,** by taking a **picture of the meters** (generator, EDL meter and flowmeter). Some operators may be illiterate, which justify the use of photos.

The engineer of each branch then **consolidates the data in an Excel file** sent to the headquarters for a monthly estimation. However, the **data is collected discontinuously and is not analyzed** to their full potential as it is not considered reliable.

Indeed, **70% (or more) of the flow meters are not working properly.** This high number is explained by the absence of protection **against water hammer** (turbine flow meters), causing them to break a few days after installation. Thus, magnetic flowmeters would be more appropriate to avoid these inconveniences.

Some sensors are connected to data loggers, but the batteries **rarely last more than 1 to 2 months**. Some wells have level sensors, however the piezometry is done manually so it is not possible to protect the pump against run dry.

Operations and distribution are affected by numerous design issues on the stations and network, as well as by the choice of assets.

Maintenance

In order to repair an equipment the following process should be followed :

- The operator calls the Operation head of department to warn of an issue;
- The **head of department issues a paper work order,** with signature and stamp;
- The document is sent to the maintenance team, then:
    a. if the repair **doesn't need parts, the repair is done**;

b. if the maintenance team requires a part from the inventory, the work order should be returned to the Operation head of department who sends the request approval to the inventory team head; **It takes usually 2 to 3 days before the part/equipment is released and accessible** to the maintenance team so they can repair the equipment or solve the issue.

*Nota: if a part needs to be purchased, **the process involves the procurement department** which should validate a request from the head of maintenance. Once the part is procured and received, the repair or replacement could be done.*

Since 2021, a **CMMS module has been commissioned on the ERP (called "SEYANA")** and allows the 3 following actions :

- **Malfunction report**;
- **Corrective maintenance**;
- **Preventive maintenance**.

Operators use a phone app interfaced with the ERP to report an issue and start the workflow. The tool accelerates the previous process by automatically sending requests and work orders to the various departments involved. It also automatically updates the inventory.

Nota: despite the use of CMMS, the paper process still needs to be followed. Every week, a summary of all work orders, and procurement requests of the week is signed by the head of each operation, maintenance and procurement departments.

Communication with Customer relation department

If the Customer Relations department receives **a complaint**, it contacts the **maintenance unit** in order to have information and to communicate it to **the customer**.

At the other end, if the **maintenance unit plans to do works impacting customers**, **it notifies the Customer Relations department** for official SLWE external communication. The wish is that the Customer Relations department gets information directly from the ERP to make the communications directly according to the maintenance.

Backup power

The generator unit is in charge of power generator (genset) operation and maintenance. With the current situation of EDL power scarcity, generator power **becomes essential** as an important portion of the water production now relies on it.

Team performs the following tasks :

- **Management and supply of the generator diesel;** it comes only from donation and the team manager has to coordinate the donation with the distribution to the most critical water production installations. As a result, he is in close contact with the operation department;
- **Maintenance of the generator;** these equipment require extensive maintenance and team members are specialized on maintaining them.

Water Quality

The water sampling technicians are in charge of collecting samples via **instructions transmitted on the EIN application** (connected to the ERP) on the dedicated tablet.

Once on the sampling site, they scan a **QR code** situated on the sampling point. It allows the EIN application to track and verify the correct sampling point. In order to ensure the correct location of the sample, a double confirmation is made through geolocation of the photo taken by the operator when scanning the code of the sampling point. This location is compared to the coordinates of the sample point in the GIS via a monthly report.

Management via **EIN ensures the quality of the sample in terms of location and delivery time** to the laboratory. In the case of missing water at the sampling point, the operator can notify it to justify the missing sample.

As for the laboratory technicians, they mainly work on the ERP to directly integrate the analysis results.

By law they have to print out and send all the results every 6 months to the Water and Energy Ministry.

There is a **daily report printed out to the production manager and an engineer** is assigned to analyze water quality and alert the production teams in the event of non-compliant quality.

3.2.2.4. Operation related digital projects

SCADA projects

Operation department lacks the capacity to monitor the production and network and controls remotely the equipment. Various already handed over or on-going projects are related to the implementation of SCADA systems (refer to focus in the chapter 3.4).

Water network performance

NRW platform project is in progress managed by the SCADA team. There are significant losses between the source, the reservoir and the distribution. However, since the **data is not reliable**, there is no follow-up of the volume produced and distributed. The final objective of this project is to develop a specific module in the GIS to format the integrated data, then, thanks to a simple formula, to obtain the loss percentage which would be displayed geographically on the map (refer to “Jezzine Project - NRW platform project” in paragraph 3.4.5).

Maintenance and CMMS

Currently the **CMMS called SEYANA** is interfaced with Navision but only in the demo environment. The CMMS must remain in the demo environment as the database of the finance module has many anomalies (especially on the assets values also managed by the CMM module). Thus, to move to the production environment, it would be necessary to first compare and correct the asset value database. This task has been estimated to take 6 months of work.

The long-term project would be to switch the whole ERP of the establishment including its modules to Business Central. So the CMMS team worked on an evolution of the current Navision CMM module in Business Central format. This evolution add significant features such as:

- work order time estimate and tracking;
- advanced procurement feature ; automatic procurement request based on inventory data, and pattern of consumption;
- automatic selection of the closed pipe from the GIS assets when getting location of the works;
- ressource schedule (staff management);
- KPI generation.

Regarding the CMMS it will be necessary to first migrate the modules that interface with it (finance etc).

Generator unit

There was a project to operate by starting and stopping the generators from a phone app. But it has been stopped in 2018 due to a lack of funds. The key objective of this project can actually be achieved with the implementation of an overall SCADA which could enable the remote operation of the generator based on operation needs.

Water Quality

No ongoing projects. The main project was the ERP Water Quality module that was deployed in 2020.

3.2.2.5. Tools used

The tools used by the department are described below:

Tools	Use	Comment
WhatsApp	Communication with on site operators (work order and flow meter readings) through groups (~10)	
CMMS	Used by the maintenance team to manage the maintenance processes of fixed assets and its consequent connection with warehouses department	Integrated on the ERP demo environnement
Diesel	Used for the generator	SharePoint Web Application
ERP : Water Quality module	Used by laboratory technicians to integrate the analysis results	
EIN application	Used by operator for sampling management	

The combination of laboratory tools made it possible to solve two major pain points in the unit : the sampling, and the management of the laboratory (especially the data reporting).

3.2.2.6. SWOT

The interview with the head of department/unit and the analysis of the existing situation resulted in the SWOT matrix below:

Strengths	Weaknesses
• Resilience of the team and management, • **CMMS module**, • Effective tools making sampling process and water quality result reliable, • GIS project in progress will help network operation and maintenance especially with the futurs dashboards that are being created, • **Available existing equipments or SCADA not yet use**, • Possible future GIS for network operation and maintenance especially with the futurs dashboards that are being created.	• Communication issues due to the geography: if the GSM doesn't work, sms or radio could be used, • Unreliability of the measuring equipment (flowmeter), • Not enough operation data to measure operational performance, • Not sufficient use of the existing tool in place (SCADA, GIS).
Opportunities	**Threats**
	• Operation of wastewater treatment plant (future SLWE perimeter) without adequate tools.

3.2.2.7. Recommendations

These solutions improve the efficiency of operations by providing immediate access to facility data.

However, before reaching this stage, it is quintessential to validate the first requirement, which is to **obtain reliable data**.

SEURECA therefore recommends that SWLE **invests in a large instrumentation supply and installation plan** to enable the implementation of the overall SCADA system and to allow the performance monitoring of the production. While the instrumentation required for the SCADA will be defined in the overall SCADA project, the instrument for the performance monitoring should be defined according to the needed KPI. These ones are being detailed in the framework of the "Technical Assistance Programme to support Reforms in the Water and Wastewater sectors in Lebanon", funded by the European Union and implemented by AFD, in the foreseen activity A14: Set up KPIs for the WEs.

The current CMMS software is unfortunately not fully used due to the issue of the current asset database in the ERP Finance module and Navision limitation. So we recommend firstly to **clean the database to match the asset audits** done by the team and then update the overall ERP to Business Central.

3.2.3. CUSTOMER AFFAIRS DEPARTMENT

3.2.3.1. MANDATE

The customer service department is entitled to **welcome new customers** and to **manage the customer complaints or questions**.

A unit responsible for the animation of social networks was created in 2018 in this department, but reports directly to the establishment's direction.

3.2.3.2. ORGANIZATION

The department is organized as below :

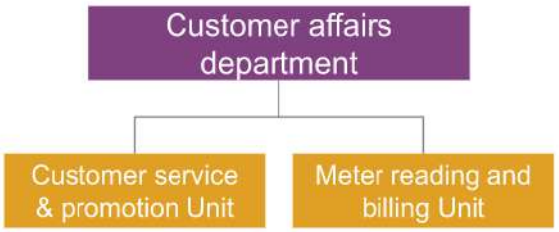


Figure 14: Customer affairs department organization

There are 4 persons in the Saida office that are responsible for receiving complaints, new user applications and user closures. In the branches, one person is responsible for carrying out the same tasks. Each branch has two computers to enter customer data (new subscriber) and billing data.

The **call center** is located in Saida and is responsible for answering questions and handling complaints.

The social media unit is also based in Saida, and is in charge of creating content on SLWE.

3.2.3.3. PROCESS AND CUSTOMER JOURNEY

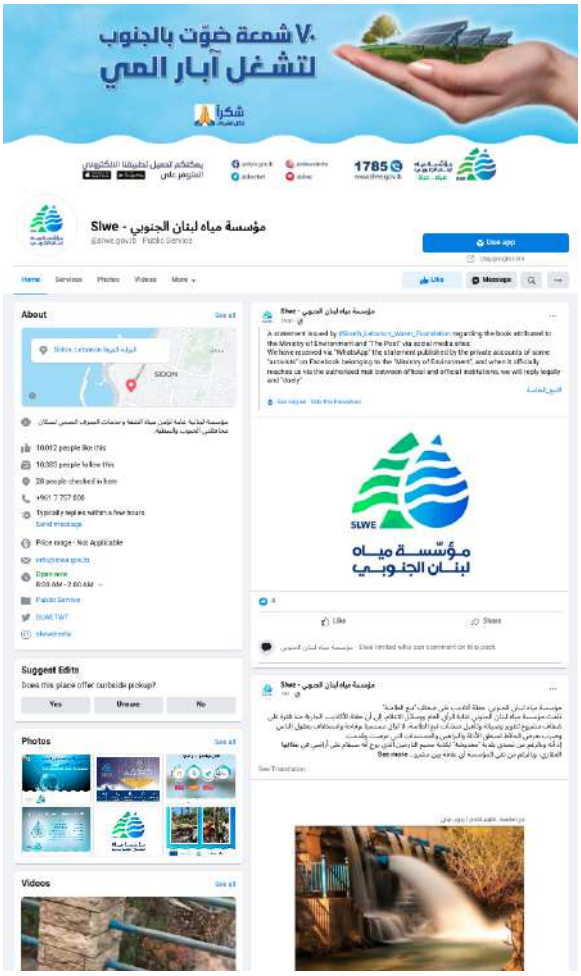
Main process

The department manages the following main processes :

- Creation of new subscriber;
- Manage existing customer including billing, claim management;
- Account closure;
- SLWE general communication.

Nota : there is no meter for SLWE customers so meter reading is not a process managed by SLWE.

The customer related processes are analyzed through the customer journey tool in the next paragraph.



Regarding SLWE general communication, **the media unit is very active on social networks** and gathers information and images (photos and videos) about ongoing projects and maintenance, public tenders etc. to share on different platforms (Facebook, Instagram etc.). They are also in charge of transferring the complaints received via social networks to the customer department, so that they can be correctly registered in the ERP for an efficient follow-up.

Figure 15: SLWE Facebook page

Customer journey analysis

This analysis aims at mapping the tools and engagement channels implemented to facilitate the customer experience.

The discussions with the customer service department resulted in a mapping of the digital tools used by the customer when interacting with the establishment.

	New customer with new connection			Subscriber life (recurrent)			Account closure, termination and transfer	
Steps	Arrival of the customer and contact for new connection	Response from the connection department	Acceptance of the quote and return of the information	Creation of the subscription	Invoicing	Possible claim	Departure - Arrival of the customer	Final invoicing and account closure
Actor/service	Client	Connection department	Client	Service Gestion des clients	Customer Management Department	Client	Client	Customer Management Department
Tasks	First contact	Making and sending the quotation	Signature and acceptance of the quote	Creation of customer account or update of existing account	Billing	Complaints management	Contact	Facturation finale et cloture de compte
Processes and activities	Connections and quotations	Connections and quotations	Connections and quotations	Subscription	Billing	Customer satisfaction	Subscription - Billing	Facturation
Channels - touchpoints	Physical presence in the office (main in Saida or in branches)	Call	Physical presence in the office (main in Saida or in branches)	Physical presence in the office (main in Saida or in branches) or through surveyor (except		Social Media (Facebook) Call center Office Application Website	Physical presence in the office (main in Saida or in branches)	Physical presence in the office (main in Saida or in branches)
Digital bricks used (or not)	NA	NA	NA	CRP	Website	CRM	CRM	NA
Comments	Fill in form Possibility to retrieve information on the expected documents to bring : - Website - Call center - Mobile application	Connection department call local employees to verify the feasibility of the connection The quotation is not send, everything is done at the office	Fill in form with expected documents Signature of the quotation to be done in the office	Fill in form Possibility to retrieve information on the expected documents to bring : - Website - Call center - Mobile application	Every beginning of the year, invoices are issued and need to be paid within the year Invoicing campaign are made through Social Media (Facebook), Application, Website, Newspaper		Verification of the pending bills on the CRM	It tooks 15 days after the office visit for the operator to come and disconnect the pipe

Figure 16: Results of the customer journey

This exercise enabled the synthesis of the information in a matrix that identified the engagement channels used by the establishment.

	Process and activities	Connection request	Subscription request	Meter reading	Billing	Invoice information	Cut-off information	Satisfaction survey	Payment	Recovery and coercion	Customer change	Claim	Subscription termination
Offline	Agency	X	X		X	X		X	X	X	X	X	X
	Mail												
	Calling center											X	
	OMT								X				
	Collector				X	X		X	X	X		X	
Online	Online website	Opportunity	Opportunity		Opportunity	(X)	Opportunity	Opportunity	(X)	Opportunity	Opportunity	X	Opportunity
	Mobile application	Opportunity	Opportunity		Opportunity	(X)	Opportunity	Opportunity	(X)	Opportunity	Opportunity	X	Opportunity
	Email				Opportunity	Opportunity						X	
	Whatsapp (to communities)						X						
	Social media						X					X	

Figure 17: Digital engagement channel

SEURECA note that :

- The upstream and last stages of the customer journey (connection) do **not offer online interaction and require the customer to visit the agency**;
- The online customer interfaces (website and application) seem to be advanced, however they have been down for several months. These interfaces could be further developed to meet new needs (connection request, subscription termination etc).

3.2.3.4. Customer affairs digital projects

The current main project in the department is the deployment of eManagement of Customer Relation , with the objective to show transparency and improve the quality of service and the customer satisfaction.

In parallel, a survey campaign is ongoing to complete and correct the customer database. A surveyor goes door-to-door filling in the CRP tool, then the completed database is automatically compared to the existing database in the ERP, and the ERP database is updated manually by accepting or not the proposed modifications.

Regarding the social media unit, an important communication has been done on 4 selected projects in 2019 :

- **KAFI**: collection application, used by the collectors to identify the customer location and identify the status of their outstanding bills. It is connected on SLWE server to the Navision database;
- **MANZOMA**: water management software used to analyze which water source should be used based on the data collected (pressure sensor, flowmeter…);
- **EIN**: water quality application, used by for the sampling, it allows to track properly a sample to ensure the reliability of a water quality analysis;
- **SEYANA**: CMMS application, used by the maintenance team to track work orders.

Figure 18: Extract from a SLWE communication leaflet

3.2.3.5. Tools used

The tools used by the department are described below :

Tools	Use	Comment
ERP : CRM module	By the department to track complaints	All complaints are registered in the CRM
Customer application : SLWE	By the customer to: • pay bills; • send Complaints/Inquiries/Questions (with picture and GPS localisation);	A user account (loggin) need to be created to access the application Application is down since several

	• find information on documents to bring for a subscription.	months (license issue)
Website	By the customer to: • pay bills; • find information on documents to bring for a subscription.	A user account (loggin) is not required to access the website Website is down since several months
Email	By the customer to: • send documents (required in the case of OMT payment) • send Complaints/Inquiries/Questions	
Whatsapp	By the department to communication with municipalities	One way communication from SLWE to the municipalities, which then shares the information in a WhatsApp group with the inhabitants
Facebook / Instagram / Twitter	By the customer to: • send document; • send Complaints/Inquiries/Questions • plan an appointment. By the department to: • publish major maintenance or projects (photo and video); • share tenders.	
Call center	By the customer to: • send Complaints/Inquiries/Questions.	
OMT	By the customer to: • pay bills	With the invoice number, the OMT can access the details to get the amount. A email need to be send to SLWE to confirm the payment and provide the ID card scan of the client.
Excel	By the department to archive the communications	Link to virtual machine folders

3.2.3.6. SWOT

The interview with the head of department/unit and the analysis of the existing situation resulted in the SWOT matrix below:

Strengths	Weaknesses
• Motivated team (internal push to move to eManagement), • Good involvement on social networks to inform customers, • Existing digital tools (website, ERP modules, etc..).	• Financial stress preventing renewal software license fees,, • Bureaucracy, • Lack of staff.
Opportunities	**Threats**
• Support from UNICEF, European Union, GVC (related to European Union),	

• Use of social networks in Lebanon.	

3.2.3.7. RECOMMENDATIONS

According to the website "ourworldindata.org", in 2020, 84.10% of the Lebanese population uses the internet. A digitalization of customer services is essential. This transition has already started with the creation of the website and the application but due to financial stress, the non-payment of licenses makes them no longer usable by customers.
Given the current context and the low number of money transfers made to pay bills, the immediate need of making the app tools available is questionable. At the other end, the website is key for the communication and customer services and should be reestablished as soon as possible.

In the long term, however, both app and website are necessary, and should be further developed to address other stages of the customer journey (subscription, termination of subscription etc.) in order to offer the customer the best possible experience by making each step of his customer journey more fluid.

3.2.4. Central Administration and Accounting & Financial departments

3.2.4.1. Mandate

The administration department is responsible for **the Procurement, the Human Resources function and the document management**. Meanwhile, the finance department is in charge of **the budget, the accounting, the warehouse and the cashier and collection**.

Bills and Collection

On the 200 000 SLWE estimated customers:

- 80 000 are paying their bills
- 70 000 are not paying their bills
- 50 000 are not even referenced as customers (illegal connexions)

According to the accounting department, the real number of customers could be around 400 000, which would mean 250,000 illegal connections…

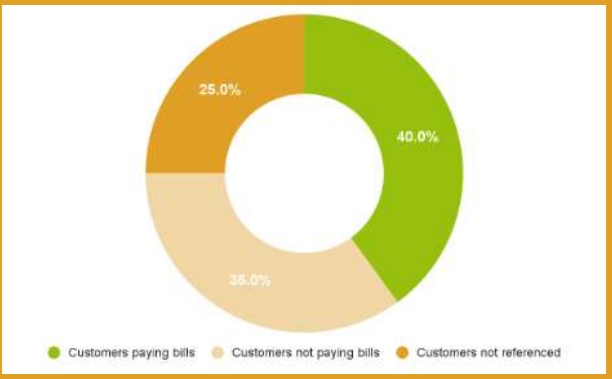


Figure 19: Customer behavior repartition

3.2.4.2. Organization

The departments are organized as below :

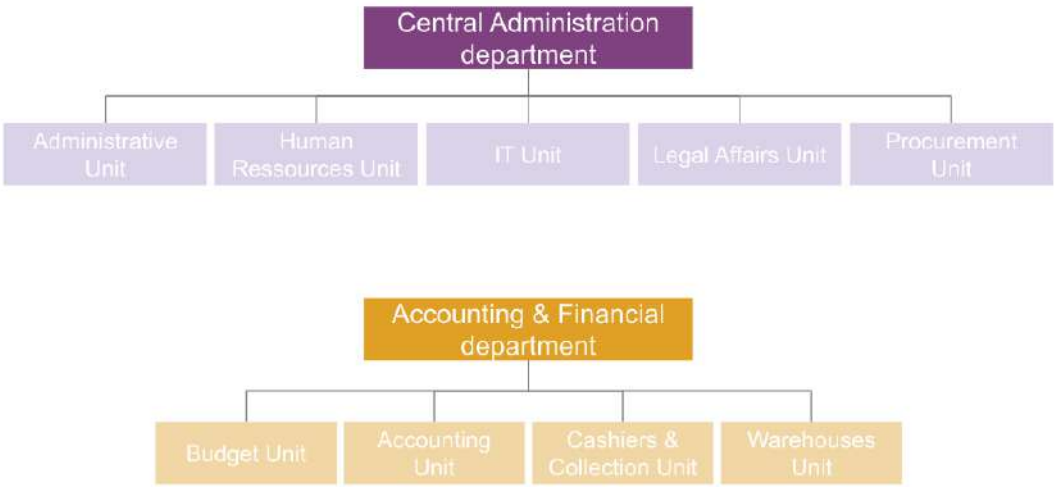


Figure 20: Central administration and Accounting & Financial departments organization

The procurement team is composed of 3 interdepartemental assessment experts with various backgrounds and 3 procurements experts.

Regarding the cashiers and collection unit, it is composed of :

- 45 collectors :
  - 5 are SLWE staff;
  - 40 are Contractors paid by collection percentage;
- 2 cashiers in Saida;
- 2 cashiers in each branch + 1 assistant (who should not have access to the ERP, but due to the current situation (lack of staff) they do have access).

The warehouse team in SAIDA inventory is composed of 6 employers. There are dedicated teams in - other branches.

3.2.4.3. Processes

Administrative unit

All the documents that circulate between the services must go through the administrative department in order to be identified and indexed (mainly the files concerning the customers or that require money). This indexing is done via the module Document Register in the ERP which generates a unique code for each document, and then allows to track the document in the different departments. To archive, the document is scanned and stored in shared files. It should be noted that the references of the documents can be different between the different departments' tools, and that only the code issued via the ERP is unique and allows to ensure the proper follow-up.

Budget unit

When a new part is needed for maintenance, the maintenance manager or the head of the production department sends a request via ERP then on paper. Therefore the Budget unit can see the request in the ERP and check whether it is available in the warehouse module in order to initiate a purchase order if necessary, even before receiving the paper document.

Procurement unit

As a public entity, SLWE has to follow the strict rules. Regarding tenders, if the amount is above 100 million dollars, it is necessary to receive 3 proposals. If the amount is higher than 200 million dollars, then it is mandatory to go through a public tender.

All the procurement process is recorded into the ERP Procurement module. It includes a supplier database with previous supplier prices.

Warehouses unit

The spare parts and consumables inventory is managed by the warehouses (including donated ones) which falls under the finance and budget department. The parts, their approximate value and their supplier are registered in a dedicated module of the ERP using a unique code which is also used in the CMM. Consumables are registered with a common code per type and they are tracked the quantity.

In the ERP is also registered:

- the number of requests;
- the destination of the part/consumable;
- who retrieves the part/consumable.

Every week a report is generated by the ERP per cost center and it is possible to edit custom reports.

Accounting unit

There is only one budget closing per year in April.

Concerning payments, the process is as follows: invoices are paid only in Saida, which forces cashiers from other branches to come to Saida to get the cash and pay at the branch level. This situation is due to the current bank situation where there is a limit in the withdrawal. Note that all the money needs to go through the Central Bank.

Cashiers & Collection unit

Water price is increasing due to the current financial stress (should be validated by the ministry):

- in 2022 : 800 000 LBP
- in 2023 : 3 000 000 LBP

ICT staff is mobilized to generate the invoices (not customer) as they are short in terms of staff.

PAYMENT DISTRIBUTION

To get an overview of the different payment processes :

- 97% are done through the collector: collectors have to check around 30 customers per day and the payment is made in cash only (customers that pay online are removed from the list thanks to a monthly notification received by the collector). Note that it is more and more complicated to collect the cash due to economical stress on customers;
- 2% are done through a cashier, the customer needs to come physically to the agency to pay, in cash only;
- And only 1% of the customers transfer directly to the Central Bank through OMT. Only the name of the client is required. Then for the audit, two to three employees need to analyze the mensual transfert report from the Central Bank, to sort the client payments (as all transactions are displayed in the reports), then the employees enter manually in the ERP that the bill has been “paid by collector”.

The penalties in case of payment delay are 2% per month, starting the following year.

3.2.4.4. ADMINISTRATION & FINANCIAL DIGITAL PROJECTS

The ERP administrative and financial modules have to continuously be updated or improved to follow the evolution of the regulation. The current major change is related to the procurement process that has been modified by recent reform.

3.2.4.5. TOOLS USED

The tools used by the department are described below :

Tools	Use	Comment
Fingerprint machine	Payroll: salary prepared according to attendance	
ERP Document register	Register all document going in the establishment	
KAFI	KAFI application developed in house in 2018 for collection to get the bill by customer	Developed in 2018 Not used as they do not have the hardware to run it during collection. KAFI is not connected to ERP.
SLWE website	Used for the payment	Website is down since several months due to non-payment of the license
SLWE application	Used for the payment	Application is down since several months due to non-payment of the license

3.2.4.6. SWOT

The interview with the head of department/unit and the analysis of the existing situation resulted in the SWOT matrix below:

Strengths	Weaknesses
• Motivated team • Existing digital tools (website, ERP modules, etc..)	• Financial stress preventing renewal software license fees, • Bureaucracy, • Lack of staff, • No SOP or documented process workflows.
Opportunities	**Threats**
• Support from UNICEF, European Union, GVC (related to European Union) • acceptance of the eSignature	

3.2.4.7. RECOMMENDATIONS

In view of the heaviness of the administrative process with signatures required in the different departments, **SEURECA strongly encourages to digitize it.** It is therefore necessary to confirm the status of the Lebanese law for public institutions regarding the obligation to have a hard copy of documents. Indeed, if these constraints are lifted, it would enable to switch to a **digital process, more reliable and more efficient.**

In addition, digital archiving of documents in the ERP would increase effectiveness.

3.2.5. STUDIES DEPARTMENT

3.2.5.1. PURPOSE

The studies department is responsible for all projects related to water infrastructure, electrical instrumentation and control (EI&C). It is in charge to :

1. Elaborate of the Master plans;
2. Prepare the tender documents;
3. Project management including technical follow up and inspecting during erection and commissioning.

3.2.5.2. ORGANIZATION

The Studies department is divided in two main teams :

- Studies : for the preparation of the tender documents
- Projects : in charge of a specific project

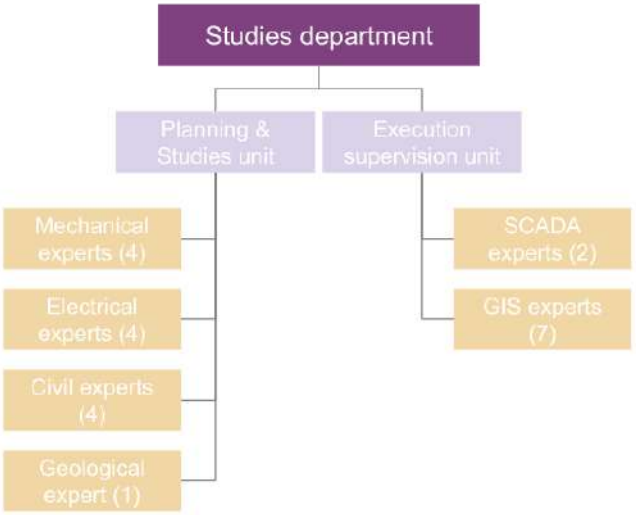


Figure 21: Studies department organization

3.2.5.3. PROCESSES

Planning and Studies Unit

These teams mainly prepare documentation and specifications for the use of contractors. The activities of the different studies teams are described:

- **Mechanical experts:** Hydraulic calculation, pump design, etc;
- **Electrical experts:** Panel design, power generator sizing, transformer sizing, etc. Current focus on solar farm projects;
- **Civil experts:** Concrete, foundation, tanks, etc.;
- **Geological expert:** Grant permission for well drilling (private or government).

GIS Unit

This team manages, create, maintain, and update, all components of the GIS system including:

- the GIS database; it is composed mainly or asset and customer information and location;
- the various layer of the GIS software (Arcgis); there are for SLWE GIS system 2 main layers transmission and distribution but step by step, the GIS system is enriched with new data to such as the water quality measures;
- the connection to other systems such as ERP or SCADA;

A massive amount of work has been performed in recent years to digitize almost all data and information that were on paper drawings.

SCADA Unit

Refer to SCADA focus on chapter 3.4.

3.2.5.4. DEPARTMENT DIGITAL PROJECTS

GIS team is involved in several projects :

- Water quality dashboard project to display analysis results on the GIS interface;
- NRW platform project to calculate and display the water balance information on the GIS using also a dashboard. Please refer to chapter 3.4.5 for more details.

The two projects use a local Client-Server functionality of ArcGis so that any computer on the SLWE IT network can access the dashboards.

A lot of SCADA projects are in progress please refer to the focus on chapter 3.3.4 for more details.

3.2.5.5. TOOLS USED

Tools	Use	Comment
Watergems / WaterCAD	Used to modelize water hammers	
AutoCAD	Engineering drawings (electrical, civil works)	
ArcGIS on desktop	Management of the GIS system	Only the GIS unit has access to the tool, willingness to open access to the head of Studies department License expired, willing to renew licenses but waiting for funds from UNICEF.

3.2.5.6. SWOT

The interview with the head of department and the analysis of the existing situation resulted in the SWOT matrix below:SWOT matrix below:

Strengths	Weaknesses
• **Knowledgeable** GIS unit and Planning and Studies Unit, • Use **top of the line** engineering, modeling	• Difficulty to **pay software** license fees, • Difficulty to retain **high profile engineers** required for the project managed by the

and operation software.	department.
Opportunities	**Threats**
	• Compliance with software license agreements / **Misuse of license**.

3.2.5.7. RECOMMENDATION

The **approach of using the GIS system to store and display operational related spatial data is relevant** and should be pursued. But developing dashboards in the GIS may **expose an inconsistency issue in the long run.**

Indeed the establishment will soon need details and **global dashboards** to track the overall performance through **operational and financial KPI** and it could not be done in GIS. It would require a dashboard tool which given the use of Microsoft ERP may advantageously be **Power BI.**

3.3. Focus on SCADA

In parallel to the digital assessment of SLWE, a focus on the SCADA has been added to this assignment. After an introduction on the key notions of this technical field, the current SLWE organization and current projects are presented and reviewed. A special attention has been given to the project called **"Regional and Local control center in Saida"**, considered by the SCADA team as the basis of the SCADA Master Plan.

3.3.1. Introduction and Mandate

3.3.1.1. Introduction to SCADA

The Supervisory control and data acquisition (SCADA) is a system of software and hardware elements that allows industrial organizations 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.

SCADA system is crucial for water utilities to improve or maintain operation efficiency by process 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:

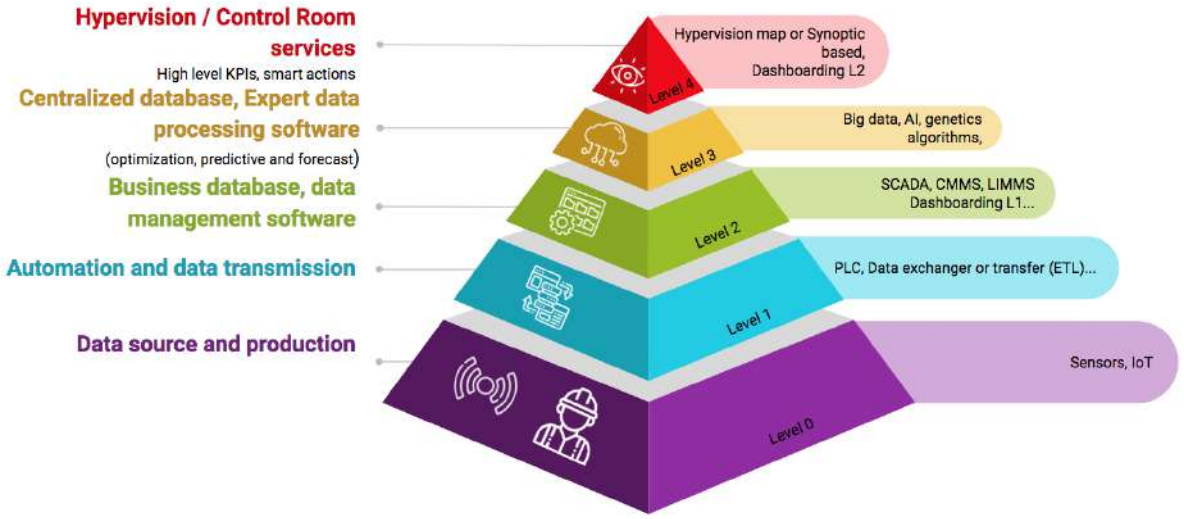


Figure 22: Computer Integrated Manufacturing (CIM) Approach (ISA-95)

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 - Centralized 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”.

3.3.1.2. 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 centralize data and processes and ensure their protection.

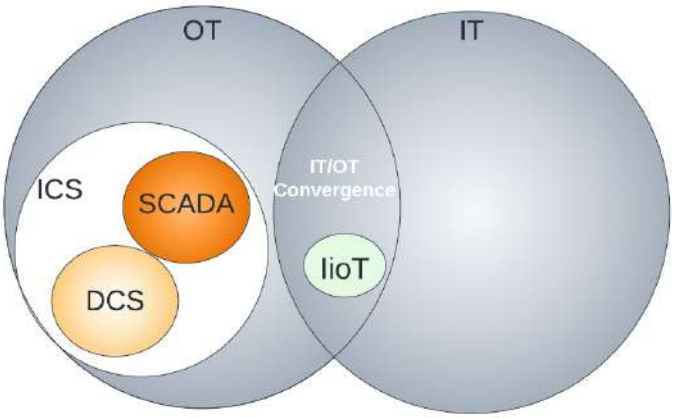


Figure 23: SCADA, ICS, OT, IT

3.3.1.3. 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.

3.3.1.4. Purpose of a SCADA team

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

3.3.2. Current SLWE Organization

The OT Team is part of the study department. It is composed of two permanent members:

- Hassan Tahhan - SCADA Team Manager

- Farah Fawwaz - Project engineer

They are supported by:

- Alamjad Salami, Digital Transformation manager ongoing and future improvement project;
- Operation maintenance site team in each of the branches. These teams are composed of communication engineers and electrical engineers and they fall under the Operation department.

Both Hassan and Farah are located in Saida headquarters.

Nota: the SCADA team was larger but 3 members resigned.

3.3.3. SCADA team Processes

The team is in charge of defining and updating the SCADA Master plan.

They supervise and coordinate the ongoing projects listed in the next section.

The SCADA team manages the SCADA workstations (virtualized on IT Server) located in Saida. It includes troubleshooting, backup. However, the troubleshooting is limited due to a lack of training on the tool.

Note that the maintenance is limited as the production team does not use the SCADA yet.

3.3.4. SCADA Projects

There are several SCADA ongoing projects. The projects below are the ones that were presented by the SCADA team during the interviews and on which we received documentation. This section aims at describing the projects with the scope, hardware and software characteristics and documentation available. A review per project has been made based on our expertise in SCADA for Water and Wastewater.

3.3.4.1. Jezzine Project - District flowmeters Remote monitoring

Project scope

The project consists of the remote monitoring of 44 district flowmeters and to send the flow via mobile network to a server situated in Saida. It was funded by “USAID” and was handed over to SLWE in 2021.

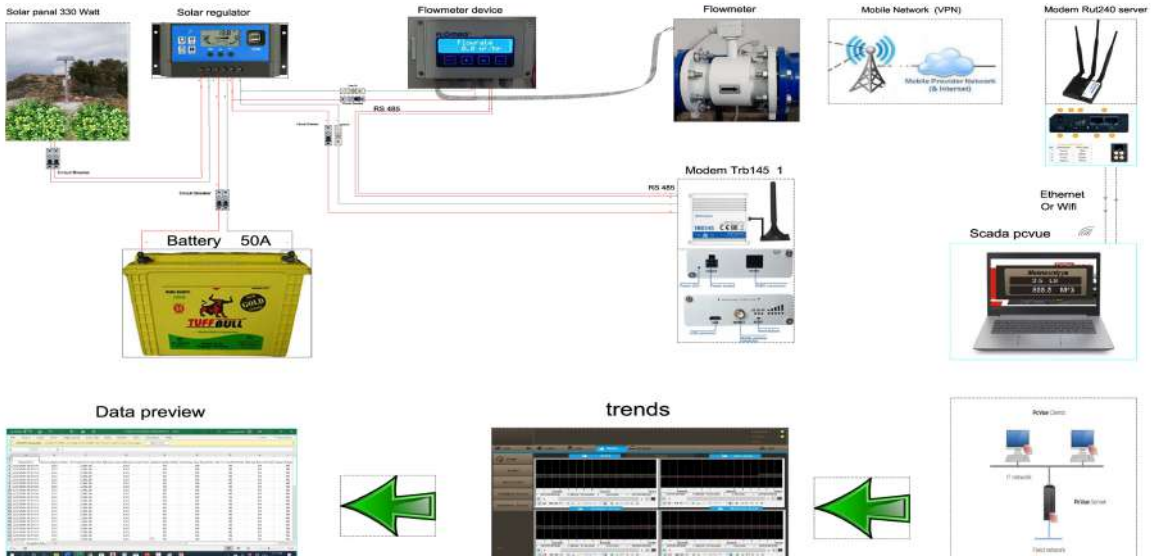


Figure 24: District flowmeters remote monitoring principle architecture

Hardware

The following hardware is used on the project:

- Panel hardware: Breaker and terminals made by Schneider electric, 24VDC power supply from unknown supplier,
- Solar panel Controller: LDSOLAR
- Instrumentation: Promag flowmeter communicating via serial bus (RS485) to the field modem,
- Communication device:
    - Field Modem : Teltonika TRB145,
    - Server modem : Teltonika RUT245 (according to documentation but it does not exist on supplier website)
- Server: Virtualized server hosted on IT server communicating with the server modem over ethernet

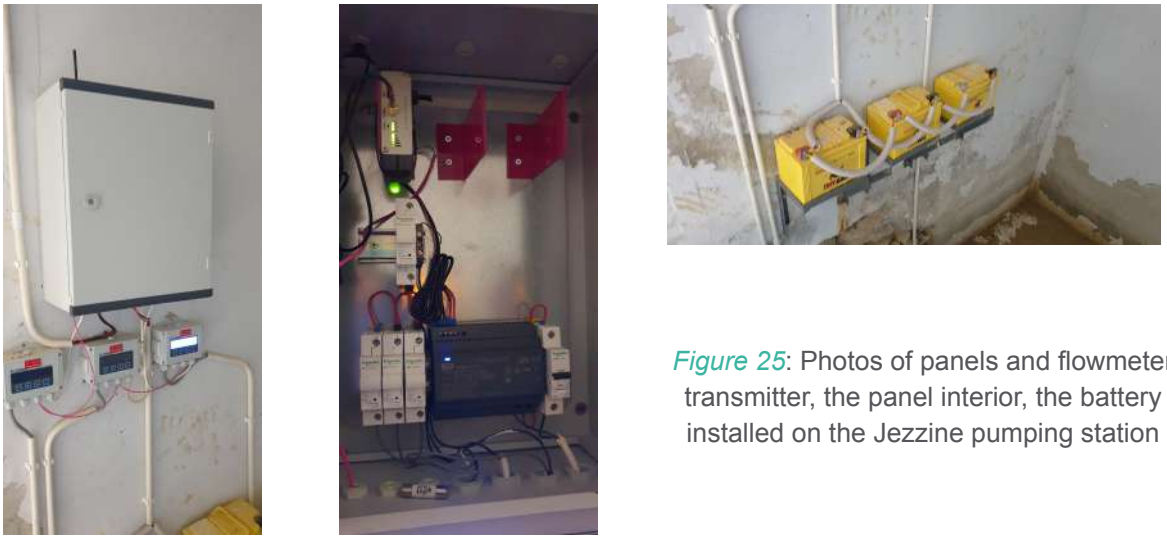


Figure 25: Photos of panels and flowmeter transmitter, the panel interior, the battery installed on the Jezzine pumping station

Software

The software is PCVUE32 using version 12, the latest version being V15. PCVUE32 is commonly used for SCADA on water and wastewater treatment plants (example of Nabatieh WWTP plant). PCVUE32 is a user-friendly, powerful tool which is typically connected to PLC controllers, collecting field data and controlling equipment from the field. Here the usage is limited to the instruments.

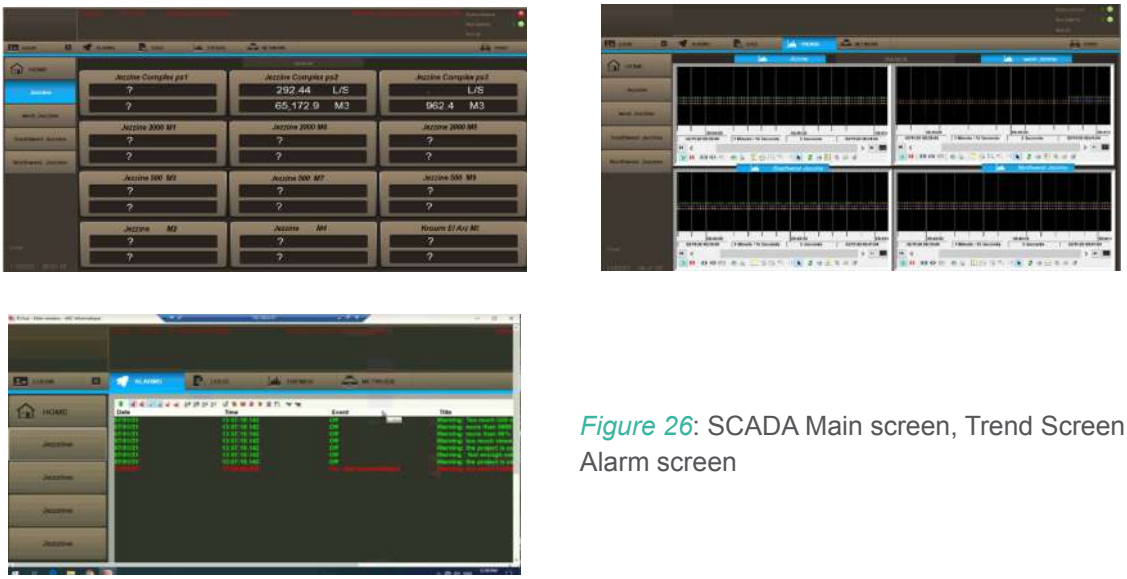


Figure 26: SCADA Main screen, Trend Screen Alarm screen

Current use and issue identified by the SCADA team

The Jezzine operation department doesn't have access to the SCADA which is only available in Saida by the SCADA department so no direct operation use has been identified.

The communication between the field and the workstation is made via GSM. It is costly so the frequency of communication has been reduced to 6 hours. Unfortunately this type of cost of inerente to any SCADA system especially for the purpose of automatic operation and NRW improvement. The frequency may have to be ajuste according to operation needs

Documentation

The documentation available for this project is limited to SCADA harcopies, pictures of the equipment and principle schemes. It doesn't seem that a typical SCADA documentation is available to maintain correctly the system such as :

- Electrical drawings;
- Detailed architecture drawings with devices addresses;
- Operation manual;
- Detailed listing of equipment.

Technical review comment

This project is uncommon with a direct link from the flowmeter to the SCADA implying a high consumption of data. Now the frequency of emission is reduced to a communication of the flow counter every 6h meaning that 6h of data is lost. For such applications a data logger or RTU is typically used to limit the data consumption and store the data (e.g. every 15 min) and only send them on a daily basis. A data logger has the advantage of being self-enclosed (no panel need), compact, typically resistant to water and harsh environments. The RTU would add to the possibility to control equipment nearby on top of the monitoring of water flow. Both Datalogger and RTU can communicate with the server via GSM/4G.

Figure 27: Example of the installation of a self enclosed data logger

3.3.4.2. Jezzine Project - Customer Meters Remote reading

Project scope

The project consists of testing the remote reading of smart meters in Jezzine city. It is a pilot project to validate feasibility and efficiency of such a system. It is funded by USAID under the same project as the district flow meters.

Due to the mountainous characteristic of Jezzine preventing it from having good radio coverage without using a lot of radio repeaters, Automatic Metering Reading (AMR) technology has been selected over Advanced Metering Infrastructure (AMI). The reading is made by a truck equipped with a radio terminal. Then the radio terminal transmits reading to the server in Saida.

Nota: a similar project is ongoing in BentJbeil but funded by CISP.

Hardware

- Smart meter: Meter with SensusRF;
- Radio terminal: Sens interface radio tool (SIRT);
- Communication between Radio terminal to server: mobile phone or tablet (data sent first to Diavaso Cloud);
- Server: Virtualized server.

Figure 28: SIRT device

Figure 29: Customer flowmeter

Software

The software used is Diavaso suite by Sensus (Xylem) :

- SensusRF CM (Collection Mobile) for drive-by reading and route management,
- SensusRF CM Web server for web access to the data

Current use

Operation department does't have access to the Diavaso web interface. Currently, no direct use of the data has been identified for this project.

Documentation

No documentation have been provided or identified

Project review

This project uses relevant hardware and software. It takes in account the specificity of this mountainous region but if generalized to the entire establishment will require an extensive float of trucks to collect the meter readings. In the current context of gas cost and staff availability, where it is easier to get funds for a project than funds to cover operation costs, it may be wise to design a Customer Meters Remote reading system using Advanced Metering Infrastructure (AMI) and implement the necessary infrastructure following the relevant technology (ex low power wide area network such as LoRa). This will also make the water balance calculations more reliable on the foreseen NRW platform project below.

3.3.4.3. Jezzine Project - NRW platform project

Project scope

The project is not per say a SCADA project but it uses the two previous projects flow outputs to build a platform to reduce Non Revenue Water (NRW). This platform will use the SLWE GIS software Arcgis. This project is self-financed by SLWE.

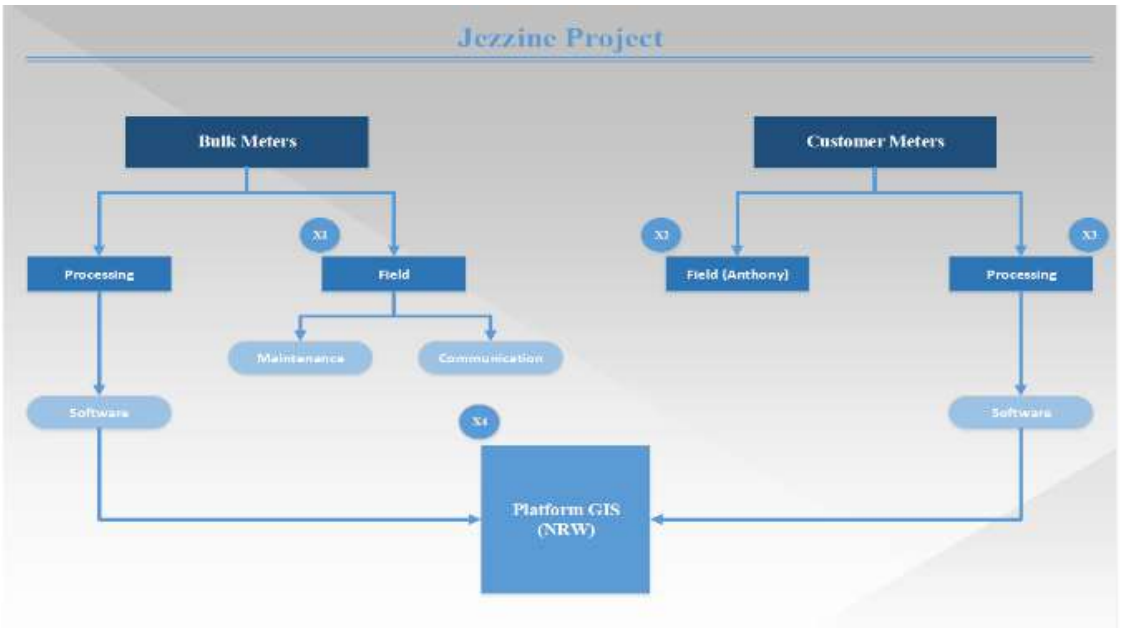


Figure 30: NRW platform concept

Hardware

N/A

Software

GIS will be linked to the PCVUE workstation and DIAVASO server so the different counters could be displayed on a GIS layer that the user can select. Calculations such as a non revenue water percentage or *Average Water Consumption per HH* (household) will be done in the GIS to compare the bulk meters values to the volume consumed by the customers and come up with the necessary KPI.

Current use

This project is under development. Once finalized, the goal is to have the operation department and management able to be able to follow the network performance via the GIS.

Documentation

The overall project concept is shown above. No other engineering documents were presented for this project.

Project review

Using the GIS script and display capability is a good idea as it centralizes the data and would make the use of the system easier. However the main issue is the availability of the data to perform proper calculations, given the lack of instrumental monitoring implementation within the establishment. SEURECA NRW experience shows that in absence of large scale meter implementation, it is relevant to focus on this installation of district and large customers meters.

3.3.4.4. Jezzine Project - Pumping SCADA and Predictive maintenance

Project scope

The project consists of the monitoring and control of the Jezzine water tanks and pumping station. The SCADA also monitors the vibration of some submersible wells pumps. The project was funded by USAID and handed over in 2018.

Hardware

- Vibration sensor: integrated to the submersible pump;
- Vibration transmitter : IFM VSE100 4 channels;
- Level sensor on tank : pressostatic level sensor make unknown;
- Modem : electronic card without casing and not branded communication via GSM;
- Panel HMIs: Bejer Electronic X2 Pro 10, National Instruments HMI;
- Vibration analyzing system : Panel PC with Hmi and laptop for configuration;
- Input Output card : Texas Instrument using internet to communicate with SCADA computer;
- SCADA workstation : standard PC.

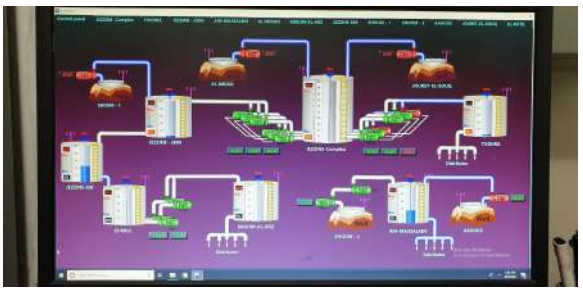
Figure 31: Vibration system panel

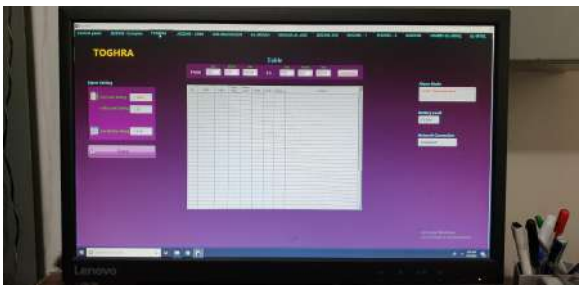
Figure 32: Modem

Software

The supervision software is made with Labview which is not an industry recognized SCADA software but thanks to a dedicated paying toolkit, SCADA application could be developed. The SCADA has a main view (see below) with equipement status and instrument measurement displayed. Several other views exist to display the status of the modem battery and history of the levels but they don't appear to be fully operational. No alarm management appears on the SCADA (alarm banner, alarm listing).

The vibration system software is Thermancy which is a performance analysis tool.





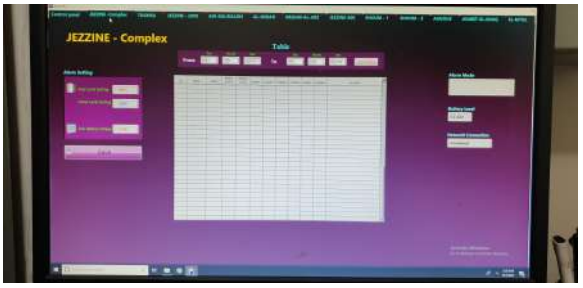


Figure 33: Jezzine SCADA computer screen

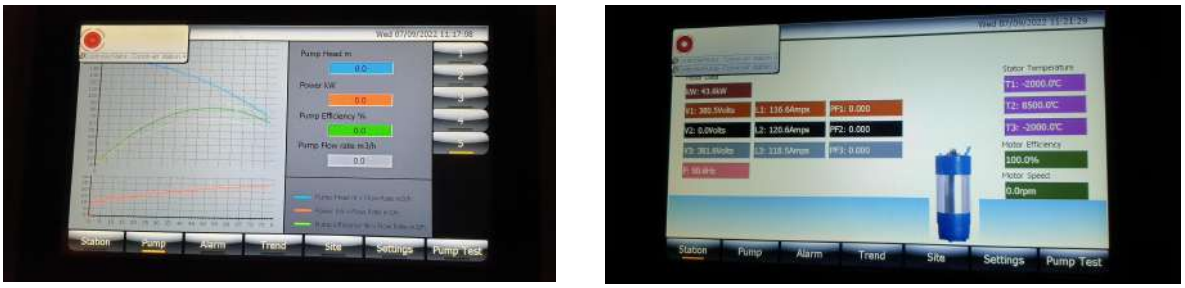


Figure 34: Jezzine Panel HMI

Current use

The pumping station operators use the SCADA computer to manage start/stop the pump according to the level in water tanks. Operators also check on the SCADA the status of the remote equipment battery.

The vibration monitoring does seem to be being used as the dedicated panel PC is not working anymore. It may be a problem of software licensing. This system was supposed to be connected to Saida but has not finally been done.

Documentation

No documentation has been provided during the visit but the SCADA team is currently searching for it.

Project review

This project, while providing a real benefit to the pump station staff, is designed using unconventional hardware and software. It is not a state of the art SCADA, or vibration monitoring system, so it is difficult to maintain or improve it, especially when the documentation is missing. Having vibration monitoring for small submersible pumps is questionable, especially due to the high cost of this system (due to the pump technology and the complex vibration analysis technology used) compared to the availability of spare parts in case of failure.

We have noticed that there were automatic valves not connected to the SCADA that could be used in the future.

3.3.4.5. Wadi Jilo Project - Well pumping and reservoir

Project scope

In phase 1, the project consists of a SCADA to monitor and control Wadi Jilo pumping composed of 6 wells. It was funded by USAID and handed over to SLWE in 2020.

Phase 2 is still in progress. It adds a reservoir and two booster stations and changes the intersite communication to optic fiber. It is also funded by USAID.

Nota due to impossibility to visit orange or red zones, Wadi Jilo installations have not been visited. All the information below comes from interviews or documentation provided.

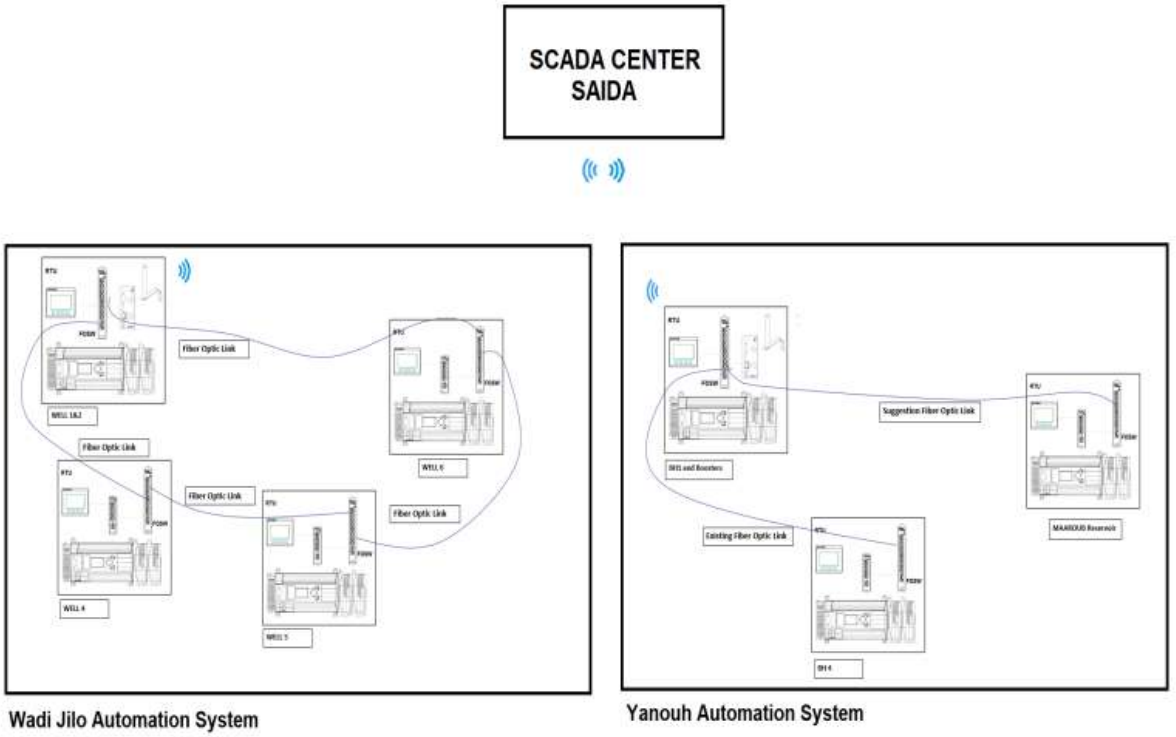


Figure 35: Phases 1 and 2 Wadi Jilo architecture

Hardware

- Instrumentation:
  - pressure measurement : Danfoss MBS3000;
  - Flow measurement: Euromag MUT2300;
  - Flow detection: Kobold PSE;
  - Level measurement: Pondus LT300RS;
- Power meter
- PLC, Input:output card : Rockwell Micrologix;
- Panel power supply : Rockwell 1606-XLE120EE;
- Switch : Rockwell 1783-US5T;
- Modem : ICX35-HWC - 3G/4G LTE Cellular Gateway;
- Panel HMIs: Rockwell 2711R-T7T (7”);
- SCADA server : Virtualized server in host on IT server communicating with the server modem over ethernet.

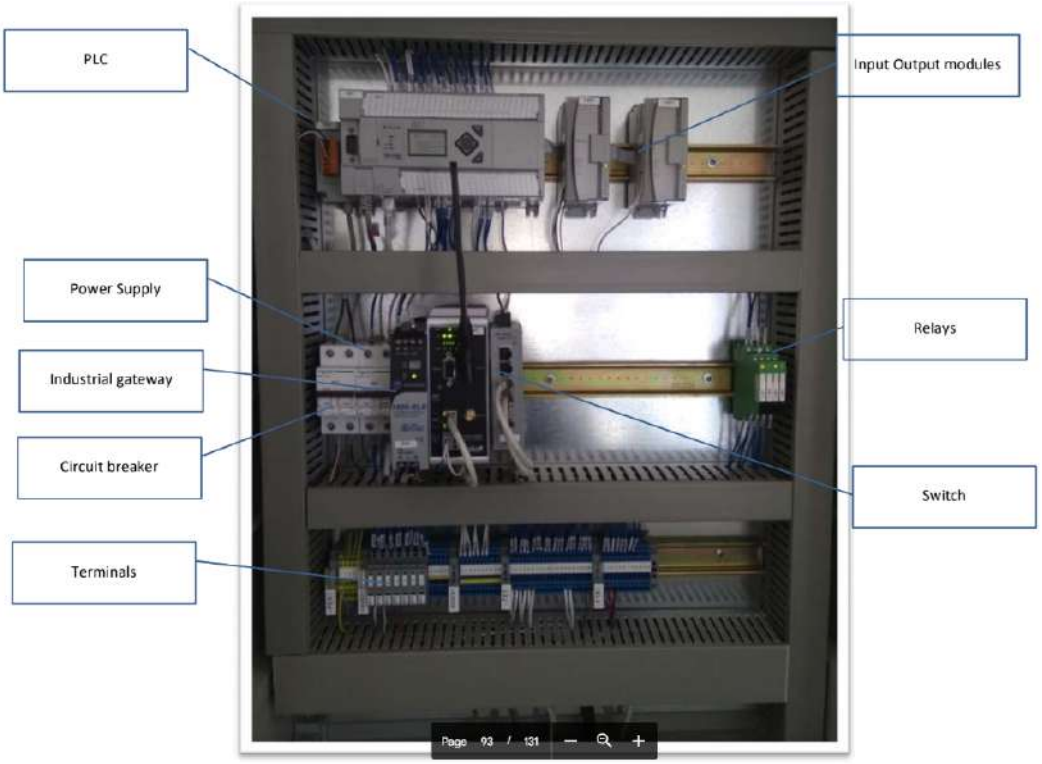


Figure 36: Wadi jilo control panel

Software

The local HMI in front of the panel runs without software; it only requires software to design and update the views (in this case Factory Studio 5000 View Designer).

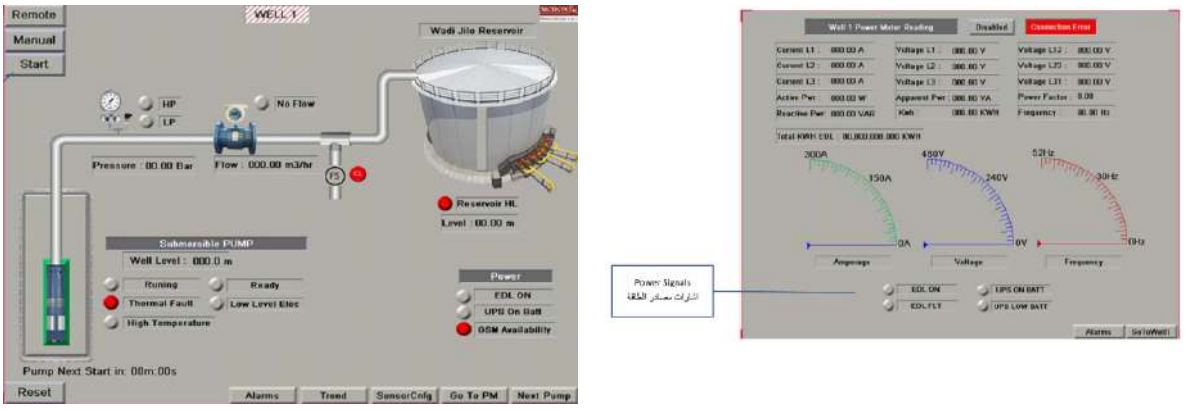


Figure 37: Local HMI Views

The SCADA software used for the SCADA workstation in Saida is Factorytalk View which is well adapted to such applications. Both HMI and SCADA views developed are of good quality with all the required basic functionalities (control and monitoring, alarms, trends, login/logout).

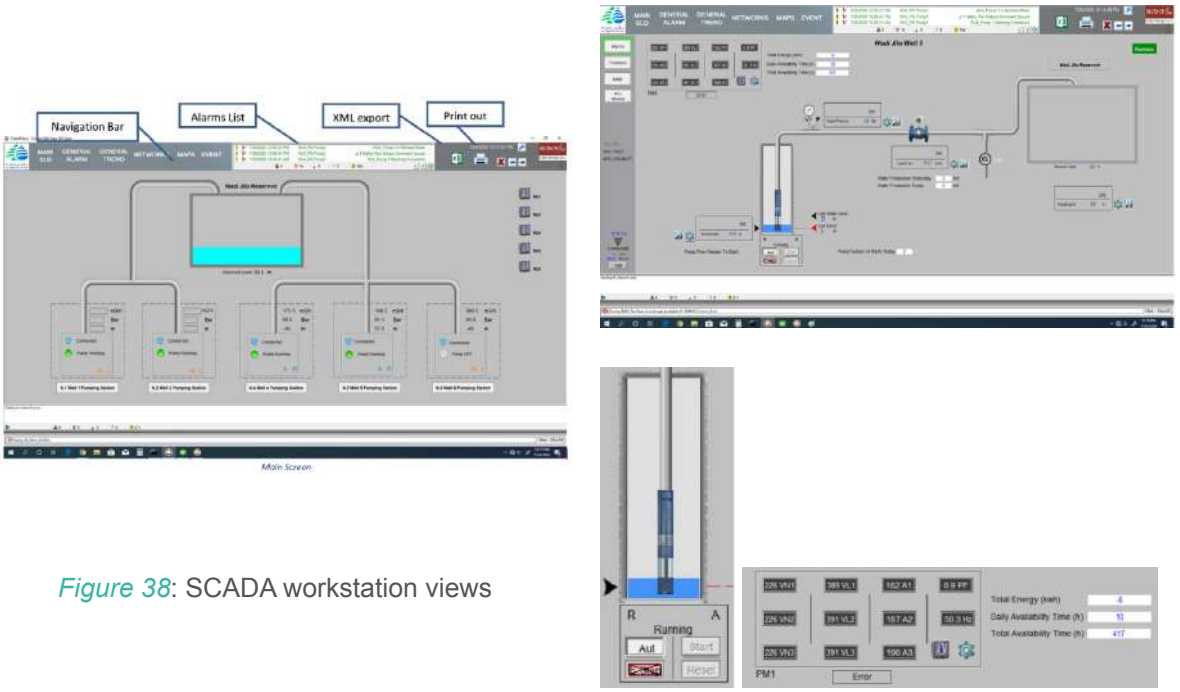


Figure 38: SCADA workstation views

Use

At the moment the SCADA team is overseeing the final phases of the link between the site and Saida main branch, after which the production department will have access to the data.

Documentation

The documentation provided is composed of:

- A Operation & Maintenance manual addressing the overall operation of equipment and SCADA but lacking some important aspects on SCADA such as the backup procedure and restore procedure for PLC program, HMI, and workstation software.
- Equipment datasheets or cut sheets.
- SCADA panel and SCADA screens pictures.

There are no proper control and electrical panel drawings nor single line drawings for the electrical supply of the pumps.

Technical review comment

This project was designed with state of the art hardware and software and could be expanded and/or used to meet the overall SCADA masterplan. Some documentation is lacking but it could be created by the SCADA department supported by the Studies department in order to maintain the system more easily.

3.3.4.6. Regional and Local control center in Saida - SCADA Master Plan

Project scope and description

A concept design has been made by DAR in 2019 called “Design for Saida et Jezzine Divisions Water Supply Main Systems”. This study addresses the water supply system for the Saida and Jezzine branch and gives the general guidelines for a SCADA and Water Management Systems (WMS) including:

- Design criteria;
- System architecture;
- Definition of a Local Control Center (LCC) per Branch and 1 Regional Control Center (RGC) for the entire establishment;
- The definition of the typical equipment per installation as well as the number of signals (Inputs/Outputs) to connect to the SCADA for Saida and Jezzine branch.

The study mentionnes other consultants for the other branches but no documents have been made available by SLWE.

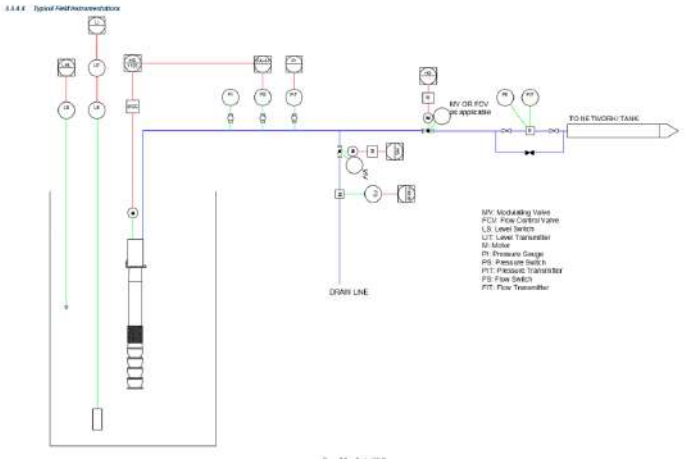


Figure 39: Typical Piping and Instrument Diagram (P&ID) for a well

Following this concept design in June 2022, DAR detailed the Local Control Center (LCC) for Saida and Jezzine and the Regional Control Center (RGC) with:

- LCC SCADA architecture;
- RCC SCADA architecture;
- LCC and RCC layout.

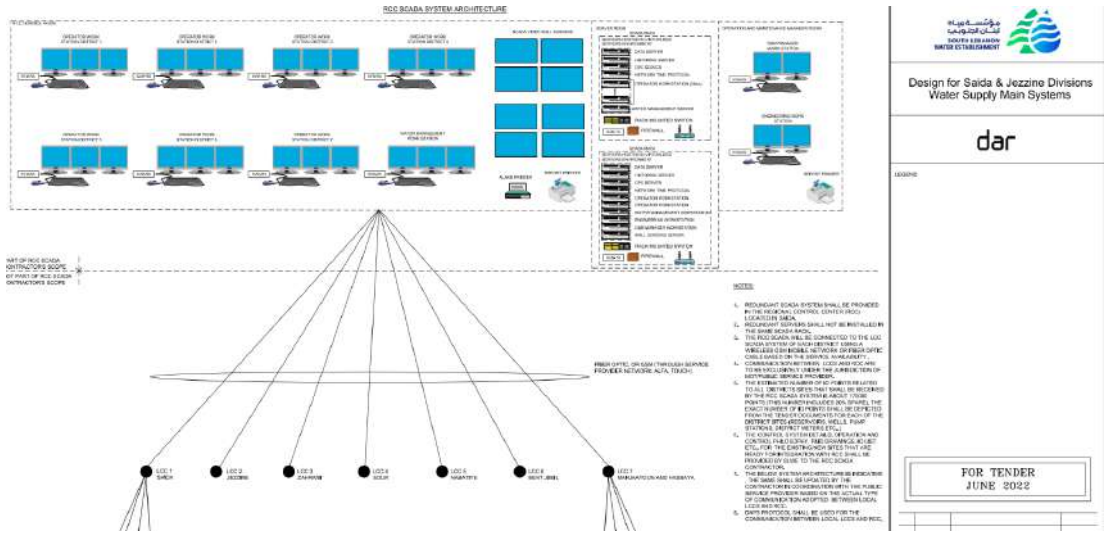


Figure 40: Extract of the RCC SCADA architecture

The concept design and following DAR drawings are considered by the SCADA team as the SCADA Master Plan that all new projects should follow. SLWE is now waiting on funding to tender and implement the projects.

Hardware proposed

- Controller: PLC for every site, redundant PLC for main pumping station, no brand recommended;
- HMI: no brand or size recommended;
- Server: not specified.

Software proposed

- EcoStruxure Geo SCADA Expert (ClearSCADA) by Schneider Electric;
- Simatic WinCC Open Architecture (OA) by Siemens;
- Factory Talk by Rockwell Automation.

Project review

SCADA system described in the concept design and drawings is **a state of the art system** with relevant design basis and requirements.However, the following **could be improved** to be more adapted to SLWE challenges and Water network specificities:

- **Remote Terminal Unit (RTU)** should be considered for remote sites with few control needs; a spreaded water network with limited fiber optical connection has to rely on radio/GSM communication and RTU are more relevant for such application. A mixed architecture of RTU for remote sites and PLC for production sites is typical for water network;
- **Communication between sites (optical fiber, GSM, etc..) should be defined** in order to finalize the design as it highly impacts the type of hardware and cybersecurity means. Note that CNP3 protocole is requested but it is not the only protocole that could be used (CNP3 is typically found for electrical networks);
- **Cybersecurity** is not addressed in the specification and should be taken in consideration in the design (use of DMZ, bastion host, etc..);
- A water management system (WMS) is described briefly in the concept design with broad functionalities and **it should be clarified how it interface with the SCADA as its features**

seem to overlaps on SCADA scope (eg “assist the operators, in real-time, on the water distribution operation”, “Manage the water resources and water quality”). Actually this WMS was created in 2019 by SLWE which called it **MANZOMA.** It has been tested on 3 pilot sources, but is not used due the absence of instrumentation and SCADA;

- For the approved manufacturer, it would make sense to replace EcoStruxure Geo SCADA by **AVEVA System Platform OMI** by Schneider as Clear SCADA that represent the future of Schneider SCADA solution and PCVUE32 which is used for Jezzine project but also on Nabatieh WWTP (future SLWE perimeter),
- Regarding the RCC and Saida LCC:
    - They are located in the same building on the last layout provided but are separated. It would make sense to regroup them and reduce the overall workstations to optimize the space and cost.
    - **There is no description of the wall screen functionalities** but it would be relevant to use it, not only for the SCADA but also to display all the other operations related software such as GIS (water quality, water balance) water management system, KPI report etc..
    - It is important to specify that the control layout, lighting, workspace design must follow ergonomic principles; it would be relevant to **request a design study** of the room by a specialist.

Figure 41: 3D modeling of a ergonomic control room

- **SCADA architecture doesn’t show:**
    - The way networks are designed (location of firewalls, managed switches, etc..) and how servers are connected to them;
    - The communication with the IT infrastructure to connect to ERP/GIS as specified in the concept design. ***SEURECA does not recommend to combine the two infrastructures for cybersecurity reasons***;
    - network time protocol servers are not typically used and necessary for water application;

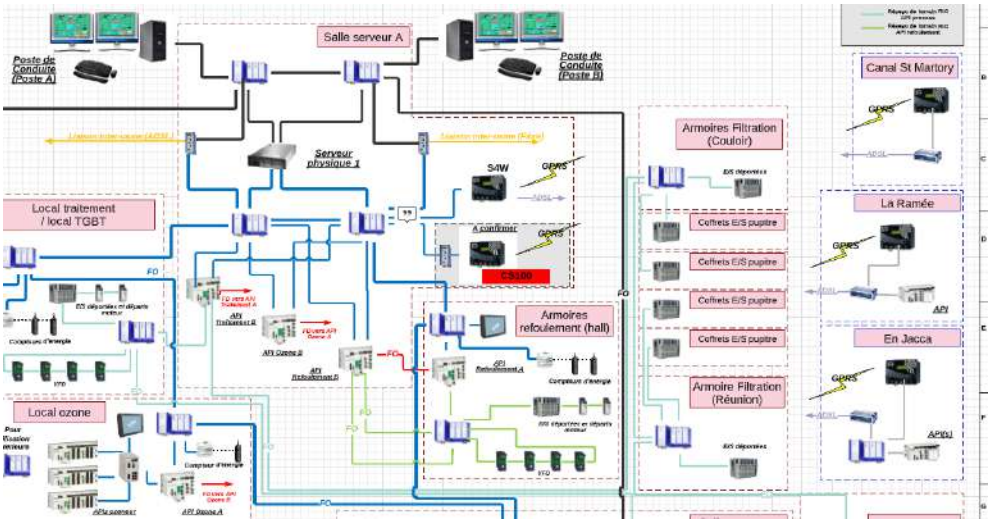


Figure 42: SCADA architecture of a Water production plant and its network for a tender

- **Number of Inputs/outputs (I/O) could be optimized:**
  - current and temperature measures are typically not used for small pumps (< 25 kw);
  - vibration measure for submerged pump is not standard on pump and are costly to installed and analyze for maintenance;
  - there is no need for two outputs (one for the start and one stop of the pump), only one command to start is enough;
  - the number of I/O for the electrical system seems luxurious for a water network (eg level of oil on transformer);
  - possibility to start/stop the Genset from the SCADA has to be added as SLWE plan to have the possibility to remotely control the GENset.
- Regarding the operation mode (automatic, manual mode) only remote manual mode is described in the concept design. **Remote manual mode from the LCC or RCC should be added** to have the same feature in LCC and RCC. Moreover, the SCADA system knows who and where the Manual mode has been requested so that clear rules of operation could be put in place (eg RCC has the priority over LCC control), this is not addressed in the document provided

The SCADA team mentionnes that the tender documents are almost finalized. Following the review above and lack of tender specifications (only tender drawings) **SEURECA does not believe that a tender could be initiated in the following months.**

3.3.4.7. TOOL USED

The tools used by the department are the one described in the SCADA projects :

Tools	Use	Comment
PCVUE 32	Monitoring of district meter	Refer to “Jezzine Project - District flowmeters Remote monitoring” paragraph
FACTORYTALK VIEW	Monitoring and control of wells and reservoir	Refer to “Wadi Jilo Project - Well pumping and reservoir” paragraph
Labview	Monitoring and control of the Jezzine pumping station	Refer to “ Jezzine Project - Pumping SCADA and Predictive maintenance” paragraph
Diavaso suite: - SensusRF CM (Collection Mobile) for drive-by reading - SensusRF CM Web server for web access to the data	Customers meters drive-by reading and route management, Web access to the data	Refer to “Jezzine Project - Customer Meters Remote reading” paragraph

3.3.4.8. SWOT

The interview with the team and the analysis of the existing situation resulted in the SWOT matrix below:

Strengths	Weaknesses
• **Motivated** team, • **Existing Long term strategy** with the Master plan, • **Possibility to reuse existing** state of the art SCADA equipment or software.	• Few dedicated staff / rely on out of department support, • Staffing with adequate SCADA skilled individuals **to challenge and follow the large project ahead (Master plan),** • **Few field equipment and instruments** able to communicate data and being controlled the SCADA, • **Lack of documentation** management • **Implementation of uncoordinated projects** with a Pilot approach.
Opportunities	**Threats**
	• **Cyber attack** on IT/OT systems.

3.3.4.9. SCADA OVERALL RECOMMENDATIONS

A lot of projects have been started over the years but SLWE does not use them with **enough benefits**. SEURECA recommends adopting a different approach on projects and stop working on Pilots or Proof of concept projects. **SCADA technologies, if using proven hardware and software, are mature enough to be designed, implemented and operated without the need to test on a small scale.**

The documentation review shows that most of the projects handed over are not well documented and it doesn't seem that SLWE SCADA team centralize it. **In order to maintain any SCADA system, SEURECA recommends paying particular attention to the documentation provided by the contractor** and not accepting the project before a strict review of the as-built documents has been made.

The concept design and drawings made of an overall SCADA system are relevant but need to be improved and detailed to evolve to tender documents ready for bid (refer to this project review comments). Implementing an overall SCADA system will be key to improve the overall performance of the operation department but it requires advanced SCADA engineering skill due to the magnitude and complexity of the project. So we recommend the following :

- **Find support from SCADA major manufacturers** to improve the SCADA overall knowledge on design via training, conference, webinar;
- **Hire a SCADA engineer specialized in engineering or a external consultant to:**
    - verify the tender documents being made;
    - lead the tender phase;
    - follow the implementation.

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, organized in accordance with SLWE's financial improvement strategic objective (Profit & Loss, Turnover and Asset Valuation).

4.1. The establishment in the next 5 years - Objectives

By defining the target during the Digital Maturity assessment, clear objectives were set by SLWE's top management and are listed below :

Digital maturity axis	Targeted maturity level	Maturity Level definition (target objectives)	Objectives #
Governance / Strategy / Organization	Level 5 - Expert	Management system and internal procedures are completely dematerialised	#GOV1
		Staff portal with dematerialised SOP	#GOV2
		ISO9001 certified	#GOV3
		Performance indicators are fully produced automatically	#GOV4
		Digital transformation involvement	#GOV5
Technology : Infrastructure / Architecture / Data / Security	Level 4 - "Advanced"	Secure architecture and policies	#IT1
		Databases are managed, including security and performance.	#IT2
		Documented ITC Business Continuity Plan for critical applications.	#IT3
		Deployment of an IT Service Management	#IT4
Customer Relation / ERP / Services digitalisation	Level 4 - "Advanced"	Streamline communication channels for customers	#CR1
		CRM evolutions (connection with CMMS, intervention time measurement)	#CR2
		Deploy a Customer Service Portal	#CR3
Public service / Asset life cycle	Level 4 - "Advanced"	Permanent updating of reinforcement, renewal and extension requirements via permanent modeling of the networks, with integration of anomalies	#PS1
		Integration of the GIS, the CMMS and the ERP	#PS2
Operation Management	Level 5 - "Expert"	Existence of a multi-trade remote management system with monitoring of alarms, measurements, remote control operations	#OP1
		Control based on predictive scenarios, daily use of decision-making tools / monitoring of consumption to optimize operation costs (energy, pumping, overflow, etc..)	#OP2
		Creation of a documented Business Continuity Plan for critical applications	#OP3

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

These resulting actions have been reorganized in consideration of the existing SLWE roadmap, shared in section 5.5 of the Appendix.

The action plan is divided into 2 parts :

- the **Enabling Framework**, which includes all the tasks required supporting the Digital Enterprise Transformation Platform actions and strengthen the institutional capacity of SLWE to implement its digital transformation ;
- the **Digital Enterprise Transformation Platform**, based on the existing SLWE roadmap (refer to appendix 5.5) and the maturity grid gap analysis, with the actions distributed according to the main axes of the SLWE Roadmap.

These actions have been grouped, prioritized and budgeted and are presented in the table below.

4.2. Enabling Framework

Action code	Action description	Related Maturity Grid Objective	Pre requisites	2023	2024	2025	2026	2027	Complexity	Priority	CAPEx**	OPEx	Budget estimate description
ENABLING FRAMEWORK											**$2 100 000**	**$500 000**	
EF-1	**ICT department reinforcement**			x	x	x	x	x				**$60 000**	
EF-1.1	Define CIO job description for recruitment Hire a CIO	#IT4	N/A	x					Medium	High			Internal staff salary
EF-1.2	Define PMO job description for recruitment Hire a PMO	#IT4	N/A	x					Medium	High			
EF-1.3	Define security officer job description for recruitment Hire security office or get external support	#IT1 #IT4	N/A	x					Low	High			
EF-1.4	Reinforce cyber security culture through training and regular refresh session	#IT1 #GOV5	EF-1.3		x				Low	Medium			
EF-1.5	Set SOP training, and regular refresh session	#GOV2	EF-1.1	x	x	x	x	x	Low	Medium			
EF-2	**ICT Infrastructure reinforcement**			x	x						**$1 000 000**		
EF-2.1	Create a secondary Data Center	#IT2 #IT3	EF-1.1 EF-1.2		x				Medium	Medium			Data center creation in a separated office. BCP,cybersecurity audit and architecure definition made by external consultant. Budget of infrastructure securisation
EF-2.2	Create of ITC Business Continuity Plan (BCP)	#IT2 #IT3	EF-1.1 EF-1.2 EF-2.1			x			High	High			
EF-2.3	Define Cyber security audit expectation (TOR) and Perform a Cybersecurity audit including risk analysis of applications softwares to identify critical ones	#IT1 #IT2	EF-1.3	x					Medium	High			
EF-2.4	Define and implement the changes to secure the infrastructure	#IT1 #IT2	EF-1.3 EF-2.3	x	x				High	High			

Action code	Action description	Related Maturity Grid Objective	Pre requisites	2023	2024	2025	2026	2027	Complexity	Priority	CAPEx**	OPEx	Budget estimate description
EF-3	**SCADA unit reinforcement**			X	X	X	X					**$210 000**	
EF-3.1	Define job description for an Instrumentation and Control Engineer with engineering and implementation experience of large scale SCADA or for SCADA Technical Assistance by a consultant (Action EF-4) Hire an Instrumentation and Control Engineer	#OP1	N/A	x	x	x	x		Medium	High			I&C engineer staff salary (external technical assistance estimated in EF4), Training of 4p by SCADA integrator and SCADA supplier, Support contract for the SCADA system.
EF-3.2	Train SLWE team on implemented SCADA hardware and software	#OP1	EF-3.1 PL-5.1			x	x	x	Low	Low			
EF-3.3	Contract specialized companies/suppliers to maintain the SCADA system (or hire Instrumentation and Control Technicians)	#OP1	EF-3.1 PL-5.1			x	x	x	Medium	Low			
EF-4	**Water Production management**			X	X						**$290 000**		
EF-4.1	Update, improve and extend SCADA master plan to the entire perimeter of SLWE	#OP1	EF-3.1	x					High	High			Consultancy support
EF-4.2	Establish an instrumentation master plan	#OP1	EF-3.1	x					High	High			
EF-4.3	Establish an energy monitoring and management master plan	#OP2	EF-3.1	x	x				Medium	High			
EF-4.4	Creation of operation Business Continuity Plan (BCP)	#OP3	EF-4.1 EF-4.2 EF-4.3 PL-5.1			x			High	High			
EF-5	**Quality Management System implementation**			X	X						**$30 000**	**$40 000**	
EF-5.1	Define quality manager job description for recruitment Hire a quality manager	#GOV3	N/A	x					Low	High			Internal staff salary, Consultancy support for ISO certification
EF-5.2	Create SOP including workflow	#GOV2	PL-1.1	x	x				Low	High			
EF-5.3	Get ISO9001 certification	#GOV3	EF-5.1 EF-5.2 PL-1.1 PL-1.2				x		High	Low			

Action code	Action description	Related Maturity Grid Objective	Pre requisites	2023	2024	2025	2026	2027	Complexity	Priority	CAPEx**	OPEx	Budget estimate description
EF-6	**ERP improvement**			x							**$600 000**	**$40 000**	
EF-6.1	Upgrade the current ERP to Business Central	#IT2	EF-1.1 EF-1.2	x					High	High			ERP development, External support to correct the database.
EF-6.2	Update the fixed assets database in Business Central or implement a new asset evaluation module*	#IT2	EF-6.1	x					High	High			
EF-7	**Continuous improvement**			x	x	x	x	x				**$30 000**	
EF-7.1	Change management (team buildling activities and workshops)	#GOV5	EF-1.1 EF-1.2	x	x	x	x	x	Medium	High			Consultancy support
EF-7.2	Establish project cloture and lessons learnt (Process improvement)	#GOV5	EF-1.1 EF-1.2		x	x	x	x	Low	Medium			
EF-8	**Support for Customer management/ internal process**				x	x					**$40 000**	**$10 000**	
EF-8.1	Implement eSignature	#GOV1 #CR2	N/A		x				Low	Medium			eSignature implementation for a global use (customer and internal documentation) Consultancy support to streamline the documentation channels
EF-8.2	Streamline communication channels via Customer Service Portal (website, application), hotline	#CR1	EF-1.1 EF-1.2			x			Low	Low			
EF-9	**Global integration of the Digital Enterprise Platform**			x							**$140 000**	**$20 000**	
EF-9.1	Create Hub specification (access, contents, tools exchanges rules)	N/A	EF-1.1 EF-1.2	x					Medium	Medium			Consultancy support, programming, testing and running
EF-9.3	Implement and test Digital Enterprise Platform Hub to access to all Platform modules	N/A	EF-9.1		x				Medium	Medium			

4.3. DIGITAL ENTERPRISE TRANSFORMATION PLATFORM

Action code	Action description	Related Maturity Grid Objective	Pre requisites	2023	2024	2025	2026	2027	Complexity	Priority	CAPEx**	OPEx	Budget estimate description
DIGITAL ENTERPRISE TRANSFORMATION PLATFORM											$32 800 000	$900 000	
PROFIT & LOSS											$13 800 000	$700 000	
PL-1	**Document and process Management System**			x							$90 000	$80 000	
PL-1.1	Implement a Document management system (DMS)	#GOV1	EF-1.1 EF-1.2	x					High	Medium			Setting, testing and license for an "on premise" DMS with workflow management tools Consultancy support for the creation of the workflows
PL-1.2	Add a workflow management tool to the DMS	#GOV1	PL-1.1		x				Medium	Medium			
PL-2	**KPI Management**				x	x					$30 000	$90 000	
PL-2.1	KPI Monitoring platform specifications (BI tool)			x									
PL-2.2	Implement a KPI monitoring platform via a BI tool (such as Power BI)	#GOV4 #OP2	EF-1.1 EF-1.2 PL-5.1 PL-6.1		x				High	High			Purchase of a data visualization tool and consultancy support for the creation of dashboards
PL-3	**ICT management**			x							$50 000	$10 000	
PL-3.1	Implement an incident management tool (helpdesk work orders)	#IT4	EF-1.1 EF-1.2	x					Medium	Medium			CrystalTrack update and late maintenance payment
PL-3.2	Implement a project management module	#IT4	EF-1.1 EF-1.2			x			Medium	Low			
PL-4	**Knowledge and HR management**					x	x	x			$90 000	$50 000	
PL-4.1	Implement a Learning Management System software (LMS)	#HR1	EF-1.1 EF-1.2				x	x	Low	Low			Implementation of a LMS software and improvement of the HR module with new functionalities
PL-4.2	Improve ERP HR module or use a software of the staff portal	#HR2	EF-6.1			x			Medium	Medium			
PL-5	**Production management**			x	x	x					$12 000 000	$400 000	

Action code	Action description	Related Maturity Grid Objective	Pre requisites	2023	2024	2025	2026	2027	Complexity	Priority	CAPEx**	OPEx	Budget estimate description
PL-5.1	Staged implementation of an SLWE overall SCADA application (including supply and installation of all the required instrumentation, control room, etc..)	#OP1	EF-3.1 EF-4.1 EF-4.2	x	x	x	x		High	High			Engineering studies, programming, testing and commissioning of the SCADA, Supply and installation of instrumentation, Software Licence.
PL-6	**Energy management**					x					$1 000 000	$30 000	
PL-6.1	Integrate the energy monitoring system with the SLWE overall SCADA	#OP2	EF-4.3 PL-5.1			x			Medium	Medium			Engineering studies, programming, testing and commissioning of MANZONA to all SLWE, Supply and installation of energy instrumentation and SCADA integration, Software Licence.
PL-6.2	Extend of MANZOMA to the entire SLWE perimeter (linked to SCADA)	#OP2	PL-5.1 PL-6.1			x			High	Low			
PL-7	**Fleet management**						x				$80 000	$10 000	
PL-7.1	Implement fleet management in CMMS (work orders)	#N/A		x	x				Low	Low			Implementation, testing and running
PL-7.2	Add GPS tool and connect it to CMMS and GIS				x				Low	Low			
PL-8	**NRW Management**					x		x			$150 000	$10 000	
PL-8.1	Extend the in-progress NRW platform to the SLWE perimeter (using customer Metering management actions)	#OP2	PL-5.1 PL-6.1 TO-1.1 TO-1.2			x		x	High	Low			Implementation, testing and running
PL-9	**Tender management**			x	x						$130 000	$10 000	
PL-9.1	Update ERP procurement module to address the regulation changes and full procurement process	#SR3	EF-6.1	x	x				Medium	Medium			Consultancy support to update the ERP procurement and to create a supplier platform to share the tenders
PL-9.2	Creation of a supplier platform or using a future government platform	#SR1 #SR3	PL-9.1				x		Medium	Low			
	TURNOVER										$18 200 000	$100 000	
TO-1	**Metering management**					x		x			$17 700 000		
TO-1.1	Deploy customer water metering for large consumers	#OP1	EF-1.1 EF-1.2		x	x			Medium	Medium			Consultancy support to deploy customer water metering to the entire SLWE perimeter (first step could be to focus only on the large consumers)

Action code	Action description	Related Maturity Grid Objective	Pre requisites	2023	2024	2025	2026	2027	Complexity	Priority	CAPEx**	OPEx	Budget estimate description
TO-1.2	Deploy customer water metering for the entire SLWE perimeter	#OP1	TO-1.1			x	x	x	High	Low			
TO-2	**Customer management**				x	x	x				$310 000	$0	
TO-2.1	Extend the Customer Service Portal features to address other stages of the customer journey (subscription, termination of subscription etc.).	#CR3	EF-1.1 EF-1.2 EF-8.1 EF-8.2		x				Medium	Low			Development, testing and running
TO-2.2	Extend the mobile application features to address other stages of the customer journey (subscription, termination of subscription etc.).	#CR3	EF-1.1 EF-1.2 EF-8.1 EF-8.2				x		Medium	Low			
TO-2.3	CMMS connected to Customer Service Portal (API) and social network	#WM3	TO-2.1				x		Medium	Low			
TO-2.4	ERP CRM improvement to include SLA (measure intervention time)	#CR2	TO-2.1 EF-6.1			x			Low	Low			
TO-2.5	Connect ERP CRM and CMMS (ex complaints, work order status)	#CR1 #CR2	TO-2.1 EF-6.1				x		Low	Low			
TO-3	**Collection management**				x	x		x			$130 000	$20 000	
TO-3.1	Improve collection thanks to improved Customer Portal Service extension (TO-2.1) and mobile app (TO-2.2)	#GOV1 #CR3	TO-2.1 TO-2.2 EF-6.1			x		x	Medium	Medium			Development, testing and running
TO-3.2	Connect the ERP to bank systems and government tax department	#SA2	EF-6.1					x	High	Low			
TO-3.3	Convert existing collection application (KAFI) to a smartphone compatible application	#SA1	N/A		x				Medium	Medium			
TO-3.4	Maximize the use of the Customer Service Portal and mobile app through communication campaigns	#CR1 #CR3	TO-2.1 TO-2.2			x			Low	Low			
TO-4	**Billing management**				x	x		x			$0	$0	
TO-4.1	Improve billing thanks to Customer Portal Service extension (TO-2.1) and mobile app (TO-2.2)	#GOV1 #CR3	TO-2.1 TO-2.2 EF-6.1			x		x	Medium	Medium			Budget estimated in TO-2.1 and TO-2.2

Action code	Action description	Related Maturity Grid Objective	Pre requisites	2023	2024	2025	2026	2027	Complexity	Priority	CAPEx**	OPEx	Budget estimate description
TO-5	**Water quality management**			X							$50 000	$30 000	
TO-5.1	Connect the Water Quality ERP to the GIS map/dashboards	#GOV4 #OP2 #PS2	EF-6.1	x					Low	Medium			Consultancy support to connect the ERP Water Quality to the GIS and KPI monitoring platform, Development, testing and running of the upgraded quality software on others establishments
TO-5.2	Integrate Water Quality KPI on the KPI monitoring platform	#GOV4 #OP2	PL-2.1		x				Low	Medium			
TO-5.3	Upgrade the Water Quality Software to its Business Central version	#OP2	EF-6.1			x			High	Medium			
	ASSET VALUATION										$800 000	$100 000	
AV-1	**Inventory management**			X							$100 000	$3 000	
AV-1.1	Upgrade the inventory management module in Business Centrale and connected it to the CMMS and Asset evaluation module*	#PS2	EF-6.1 AV-3	x					Low	High			Development, testing and running
AV-2	**Corrective maintenance**					X					$700 000	$21 000	
AV-2.1/AV-3.1	Upgrade the CMMS module to its advanced version in Business Central and connected it to the asset valuation module*	#PS2	EF-6.2	x					High	High			Development, testing and running
AV-2.2	Connect GIS to CMMS (API to get real time data in both ways)*	#PS2 #WM1 #WM2	EF-6.2	x	x				Medium	Medium			
AV-3	**Preventive Maintenance**				X	X	X				$150 000	$0	
AV-3.1/ AV-2.1	Upgrade the CMMS module to its advanced version in Business Central*	#PS2	EF-6.2	x					High	High			Refer to "AV-2 Corrective maintenance" Budget
AV-3.2	Extend CMMS features to network asset renewal based on GIS data and network anomalies*	#PS1	AV-2.2		x				High	Low			
AV-4	**Infrastructure assets**					X	X				$0	$0	
AV-4.1	Manage ICT Hardware asset in the ICT software (ISTM) and connect it to Inventory management	#PS2	PL-3.1 PL-3.2 AV-1.1				x		Medium	Low			Budget estimated in the PL-3

Action code	Action description	Related Maturity Grid Objective	Pre requisites	2023	2024	2025	2026	2027	Complexity	Priority	CAPEx**	OPEx	Budget estimate description
AV-4.2	Manage SCADA Hardware asset in the ICT software (ISTM) and connect it to Inventory management	#PS2	PL-3.1 PL-3.2 AV-1.1				x		Medium	Low			

Nota :

* New or upgraded CMMS, Inventory and asset evaluation modules will constitute an overall Asset Management Software

** The pricing was based on tools/modules from the Microsoft suite, as well as on web-based tools.

4.4. Digital enterprise transformation platform roadmap update

Based on the elements previously listed and prioritized, the SLWE Digital Enterprise Platform (refer to Appendix 5.5) has been updated with the different actions categories distributed according to the necessary timeframe and level of impact on the utility's financial performance.

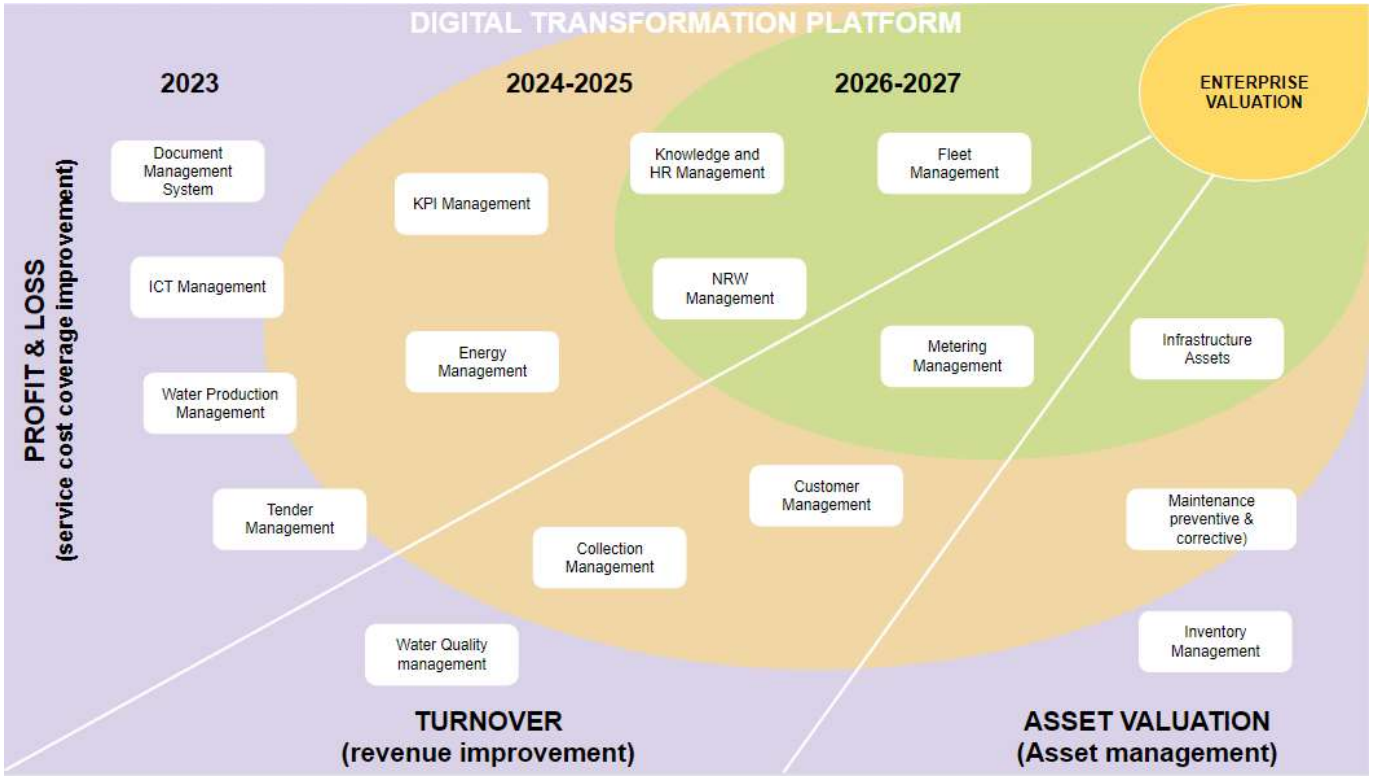


Figure 43: Updated SLWE Roadmap

4.5. Risk analysis & mitigation

A risk analysis below highlights the potential threats as well as the mitigation actions to avoid or limit these risks.

Risks*	Mitigation actions
No change management during the deployment of the solution	Always include a portion of the project budget for change management (user support, training, communication campaign, etc.). We recommend at least 5%.
Geopolitical conflicts that can slow down / stop the implementation of certain projects	Breaking down the actions into smaller ones ensures that they are completed.
Due to the large number of projects and their presence in different sectors/teams, there is a risk of decorrelation	A clear line carried by the CIO, and supported by the PMO and the existence of precise technical specifications for each project
No local competencies for experts (CIO, PMO, SCADA…)	The use of external Technical Assistance to find experienced profiles
Capacity to hire and keep ressources	The use of external Technical Assistance to complement unfilled positions

**orange =>intermediate risk / red => high risk*

A Technical Assistance to support SLWE 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 organized 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.

4.6. NEXT STEPS

Moving forward, SEURECA strongly recommends to start with the implementation of the following actions which are considered critical success factors of mandatory for the Digital Transformation success and shall provide quick-wins necessary to initiate the change process:

- EF-1.1, EF-1.2, EF-1.3, EF-3.1, EF-5.1: Hire a dedicated team (CIO, PMO, security officer, quality manager…)
    - Necessity to create the job description for the different positions
- EF-2.3: Realize a cybersecurity audit including risk analysis of applications and softwares to identify the critical ones
    - Necessity to write the audit expectations (ToR)
- EF-4.1: Extend the SCADA master plan to the entire perimeter
    - Necessity to write the ToR for such a mission
- EF-6.1 : Upgrade the current ERP to Business Central
    - Update Navision to the latest version of Business Central
    - Update the CMMS module
    - Create a new procurement database
- PL-2.1: KPI monitoring specifications
    - Necessity to have an external feedback on the work already done internally
- EF-9.1: Create Hub specification (access, contents, tools exchanges rules)
    - Necessity to write the ToR for such a mission

5. Appendix

5.1. Meetings and mission program

Date	Topic
30/08/2022	➡ Kickoff meeting : Introduce the team and the methodology, address detailed scheduling of the visit ➡IT Department : presentation of the organization and duties, Digital/IT Tools mapping and IT projects
31/08/2022	➡ Focus on operation tools : SCADA projects (on going, finalized) ➡ Customer service : Understand current key customer service processes, brainstorm on a optimized customer experience, customer journey definition
01/09/2022	➡ Focus on operation tools : SCADA & GIS projects (on going, finalized), ➡ Focus on accounting & financial department : Key business process identification
02/09/2022	➡ Digital maturity assessment and target : Presentation of Digital maturity score, definition of the key objectives
03/09/2022	➡ Digital maturity assessment and target : Update of digital maturity, quick wins identification
05/09/2022	➡ Focus on operation processes : Key business process identification ➡ Focus on Quality Control : Key business process identification
06/09/2022	➡ Dataflow within the utility : Department duty and workflow of data within the utility ➡ Focus on procurement and HR processes : Key business process identification
07/09/2022	➡ SCADA Audit : Jezzine visit
08/09/2022	➡ Mission Wrap-Up : Mission Restitution presentation

5.2. List of people met

Department / Unit	List of attendees
IT Department	Hassan Al Hussein : Head of department
Studies Department	Ali Keserwan : Head of department Hussein Hayek : Head of GIS unit Hassan Tahhan : Head of SCADA unit Farah Fawwaz : SCADA team
Customer Services Department	Nidal Hashisho : Head of department Wadih Kassab : CRP unit manager
Operation - Production department	Maroun Choufani : Head of department Ali Ibrahim : Operation Team Hussein Saad : Operation Team
Administration department	Hussein Alghool : Head of department
Financial Department	Milad Nahle : Head of department

5.3. List of SWLE installations

Region	Main Station	Type	# of Wells	# of tanks
ZAHRANI	Teffehta	Pumping Station	65	62
TYRE	Chehabiyyeh	Regional Tanks	147	168
	Wadi Jilou	Pumping Station		
	Rass El Aïn	Pumping Station		
	Al Bass	Pumping Station		
	Batoulay	Pumping Station		
	Siddikine	Pumping Station		
	Yanouh (Wadi Jilo 2)	Pumping Station		
	Rachidiye 1	Pumping Station		
	Rachidiye 2	Pumping Station		
SAIDA	Al Fouwar	Pumping Station	106	119
	Rafik Al Hariri	Pumping Station		
	Haret Saida Al Kobra (Majdelyoun)	Pumping Station		
	Nabe'e Al Tassi	Pumping Station		
NABATIEH	Abar Fakher El Dine	Pumping Station	83	120
MARJAYOUN HASBAYA	Al Wazzani Al Tahta	Pumping Station	40	80
	Al Wazzani Al Fawqa - Mayset	Pumping Station		

	Al Hasbani	Pumping Station		
	Marj El Khokh	Pumping Station		
	Ebel Al Sakki	Pumping Station		
JEZZINE	Jezzine Wells Complex	Pumping Station	33	119
BENT JBEIL	Al Taybeh	Pumping Station	75	204
	Al Taybeh (Litani)	Pumping Station		
	Kafra	Pumping Station		
	WadiElSlouki	Pumping Station		
	Saff El Hawa	Pumping Station		
	Markaba	Pumping Station		
	Chakra	Pumping Station		
	Ech Charqiye Regional (Fares el Battah)	Regional Tanks		

5.4. SLWE STRATEGY 2020-2025

مؤسسة مياه لبنان الجنوبي
SOUTH LEBANON WATER ESTABLISHMENT
SLWE

SLWE STRATEGY
2020-2025

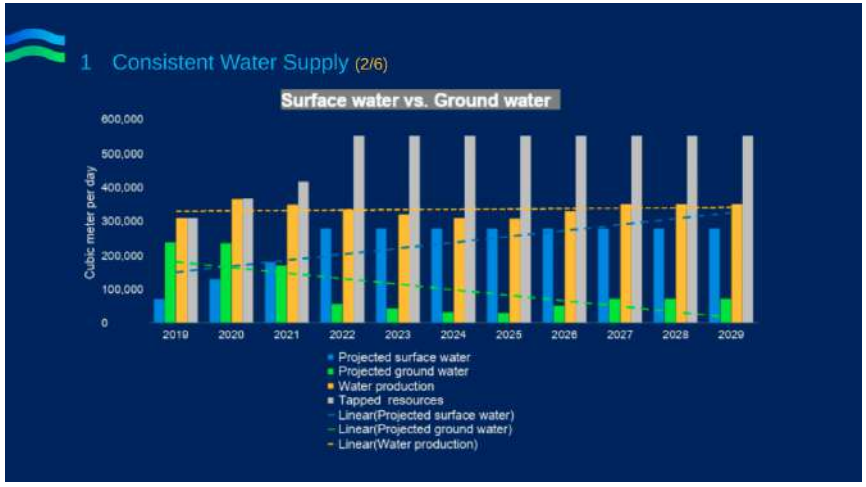
Mission

Non intermittent supply of water in an optimized cost manner and environmental perspective to allow for adequate human and infrastructure development and customer satisfaction

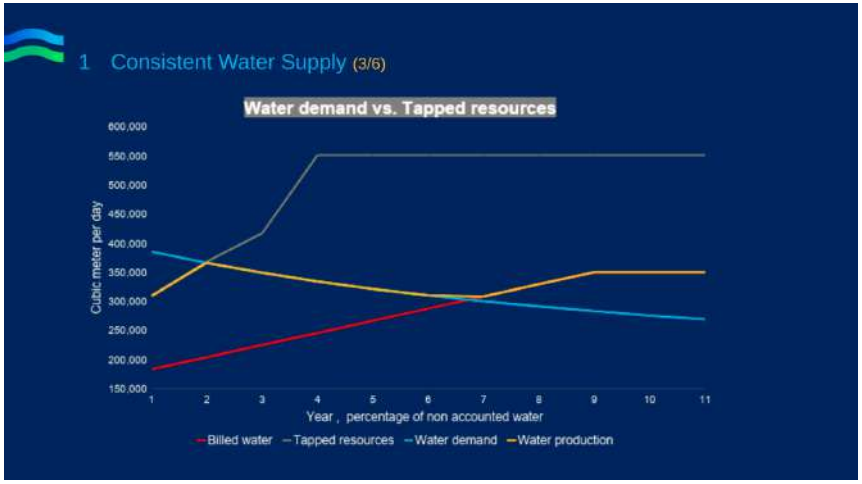
Vision

Water to the south within 3-5 years

1 Consistent Water Supply (2/6)



1 Consistent Water Supply (3/6)



1 Consistent Water Supply (4/6)

Development / Rehabilitation of water networks
Increase Storage capacity

Ensure that all towns and villages are appropriately supported by water service infrastructure:

Build new reservoirs to increase storage capacity

1 Consistent Water Supply (5/6)

Automation

1 Consistent Water Supply (6/6)

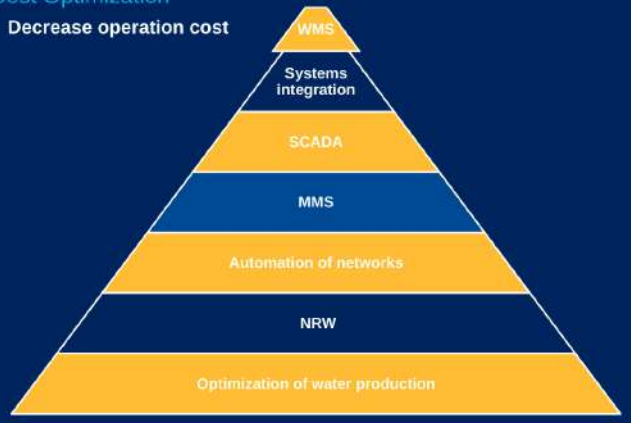
Power

2.0 Drinking Water Quality

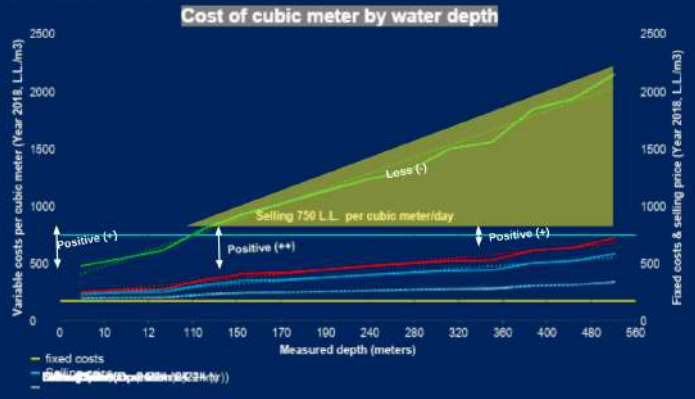
Control of pollution

3.0 Cost Optimization

Decrease operation cost



3.1 Cost Optimization



3.2 Cost Optimization

Decrease power cost

Increase equipment efficiency by replacement of old and inefficient pumps and include variable speed controls and intelligent programming of their operation

Introduce renewables for consistent levels of service at least cost

Plan the water supply in accordance to seasonal demand to reduce unnecessary power consumption

3.3 Cost Optimization

3.4 Cost Optimization

Increase technology/Automation

Monitor the operational parameters with better access and analysis of data

Control and operate remotely for better use of labor

Collect and record operation/status data for process improvement

3.5 Cost Optimization

Decrease NRW

Prevent illegal and unregistered connections to the transmission and distribution systems

Monitor NRW losses and leaks through metering and SCADA control

Implement domestic metering program (Installation of smart meters instead of gauges) to raise consumer awareness

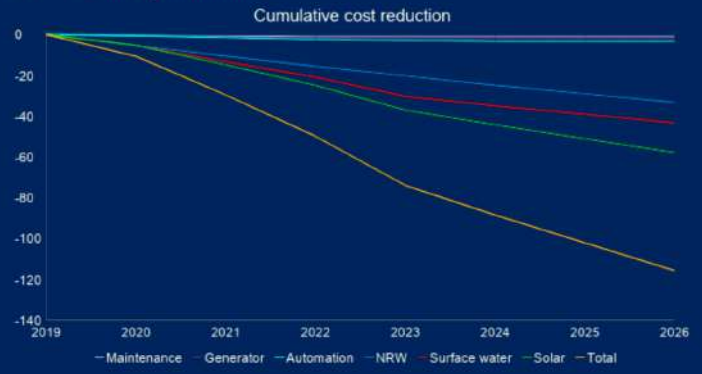
3.6 Cost Optimization

Decrease maintenance cost with In-house capabilities and training

Train and build the capacity of qualified staff needed for the operation and for the in-house maintenance of pumping stations and networks

Develop a maintenance management system (MMS)

3.7 Cost Optimization



4. Customer Satisfaction

Customer service

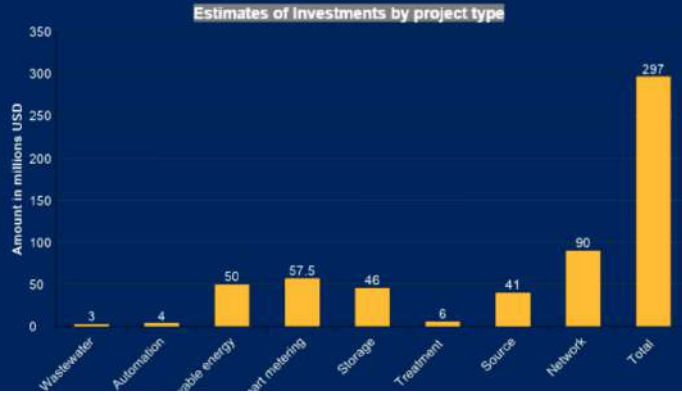
Call center

Customer interface (interactive platform, social media...)

Mobile application

5. Investments

Capital needs for South Lebanon Water Infrastructure 2019-2023



5.1 Investments

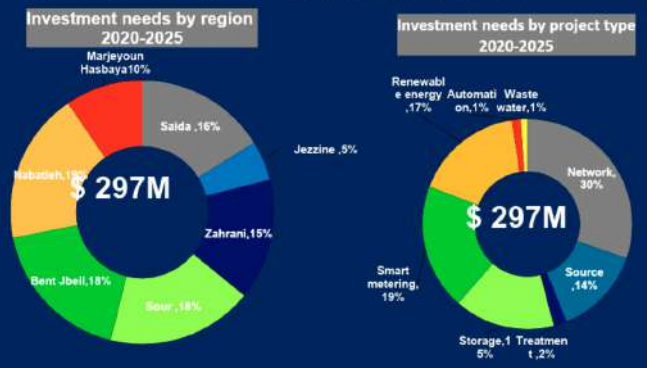
Capital needs for South Lebanon infrastructure 2020-2025

Amounts in Millions USD

Region	Network	Source	Treatment	Storage	Smart metering	Renewable energy	Automation	Waste water	Total by region
Saida	11	2	1	9	16.9	7.14	0.57	0.43	**48**
Jezzine	1	2	0	1.5	1.8	7.14	0.57	0.43	**14**
Zahrani	16	7.5	0	8	4.5	7.14	0.57	0.43	**44**
Sour	20	2	3	8	12.2	7.14	0.57	0.43	**53**
Bent Jbeil	22	3.5	2	10	7.8	7.14	0.57	0.43	**53**
Nabatieh	11	20	0	6	10.2	7.14	0.57	0.43	**55**
Marjeyoun/Hasbaya	9	3.5	0	3.5	4.1	7.14	0.57	0.43	**28**
Total by type	**90**	**40.5**	**6**	**46**	**57.5**	**50**	**4**	**3**	**297**

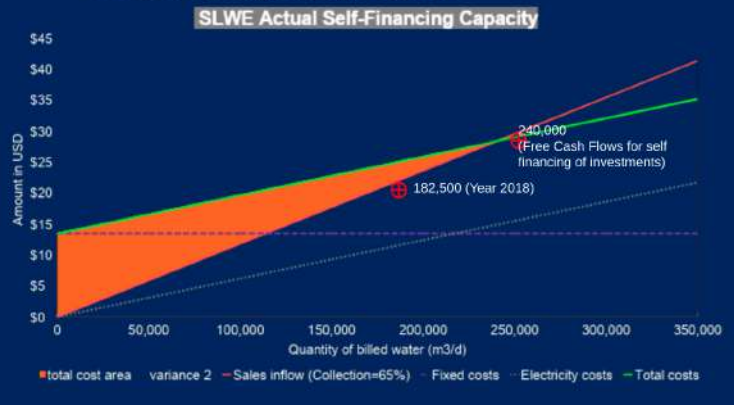
5.2 Investments

Capital needs for South Lebanon infrastructure 2020-2025



5.3 Investments

SLWE self-financing capacity – Year 2019

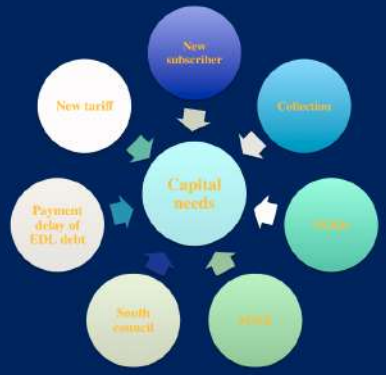


5.5 Investments

Cash position during investment period

5.6 Investments

Potential sources for funding the new investments



5.6 Investments

External funds to be provided between 2020-2025

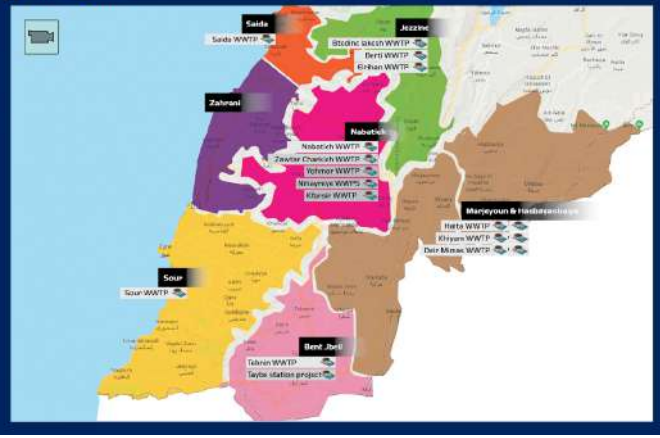
Amounts in USD

	2019	2020	2021	2022	2023
	(6,981,667)	1,338,267	10,998,433	23,396,833	31,282,133
	(41,163,000)	(48,243,000)	(45,323,000)	(42,403,000)	(39,483,000)
	19,667,000	7,000,000	27,000,000	27,000,000	27,000,000
	(28,477,667)	(39,904,733)	(7,324,567)	7,993,833	18,799,133

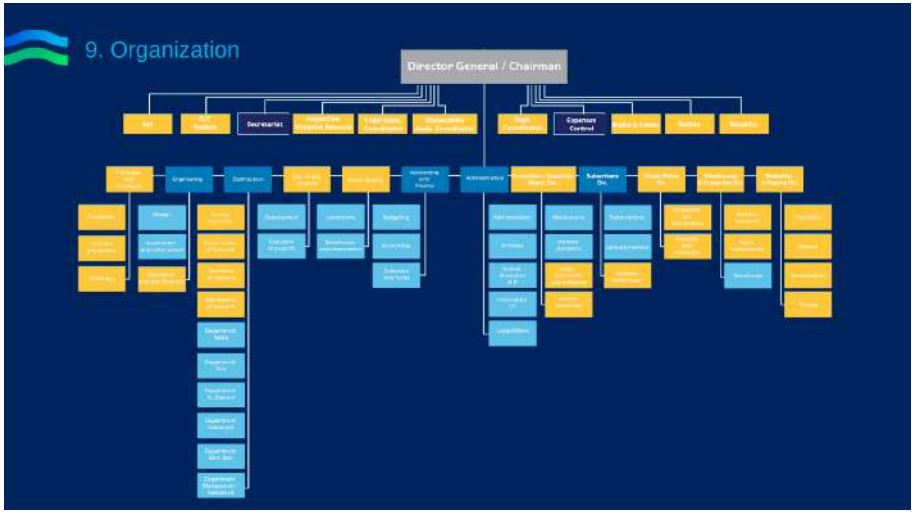
6. Projects by Type

Sources	
Water storage	▪ Extension of Mayssat Pumping Site ▪ Water supply from Nabaa el Tasse to Saida water division
Water Network	▪ Water Supply Systems in Jabal Amel Region – Phase III, South– Lebanon
Water Quality	• Upgrade of laboratory infrastructure project • Upgrade of laboratory functions project
Renewable energy	▪ Construction of solar farms in various localities for generation of clean energy: project consisting of 5
NRW	▪ Installation of smart meters for real-time water data by AMR/AMI technologies and SCADA integration
IT	▪ Installation of new servers, upgrade of server room, purchase of licences, development of MMS software for
Customer interface	▪ Launching Call Center, Mobile application, customer relation portal, social media, PR officer in dept.
Data cleaning	

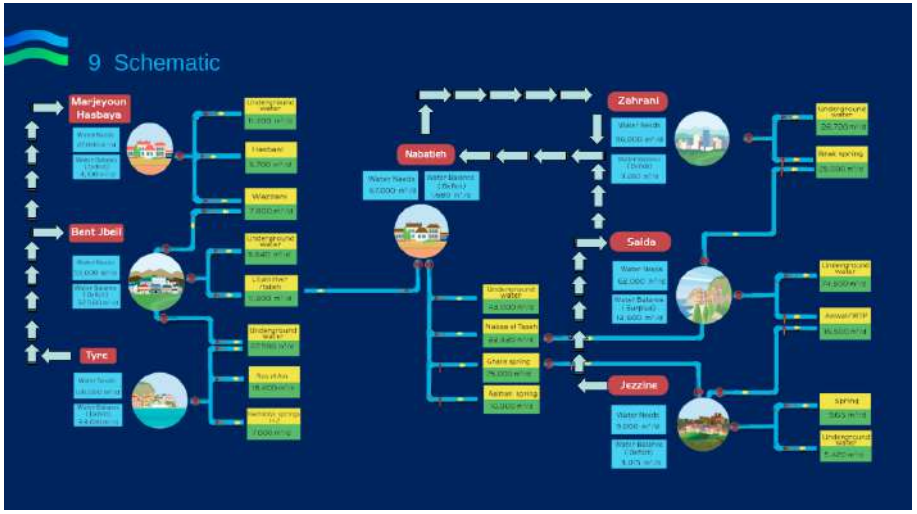
8. Waste Water



9. Organization



9 Schematic



10 Currently Needed Projects

Ghaleh Spring

Solar Power System For Alman Project

Ramieh Wells

Thank You

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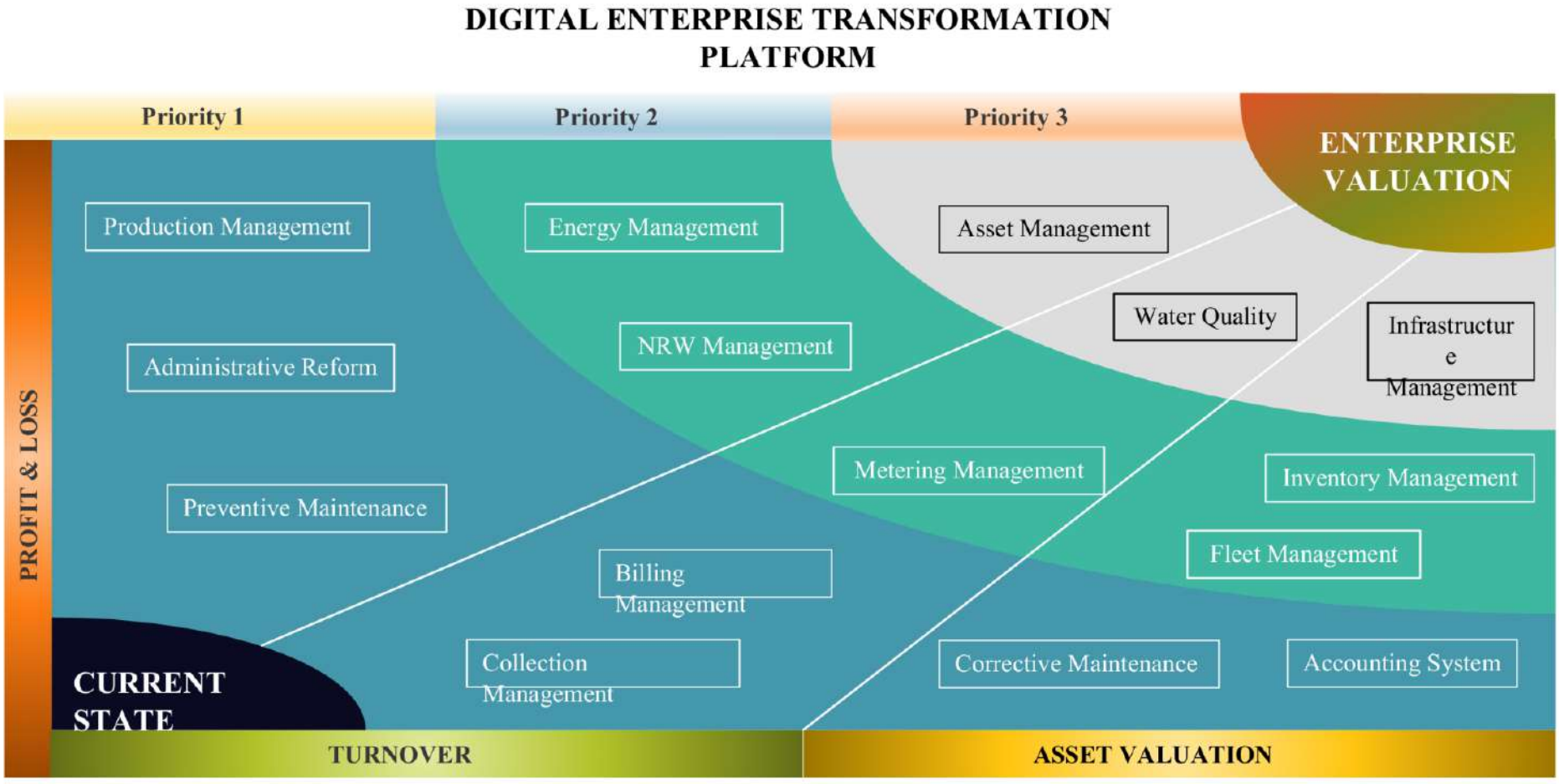
5.5. SLWE Digital Enterprise transformation platform



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