Advanced Water Asset Rehabilitation Portugal

AWARE-P

Urban water infrastructure asset management: a structured approach in four Portuguese water utilities

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Scope & objective

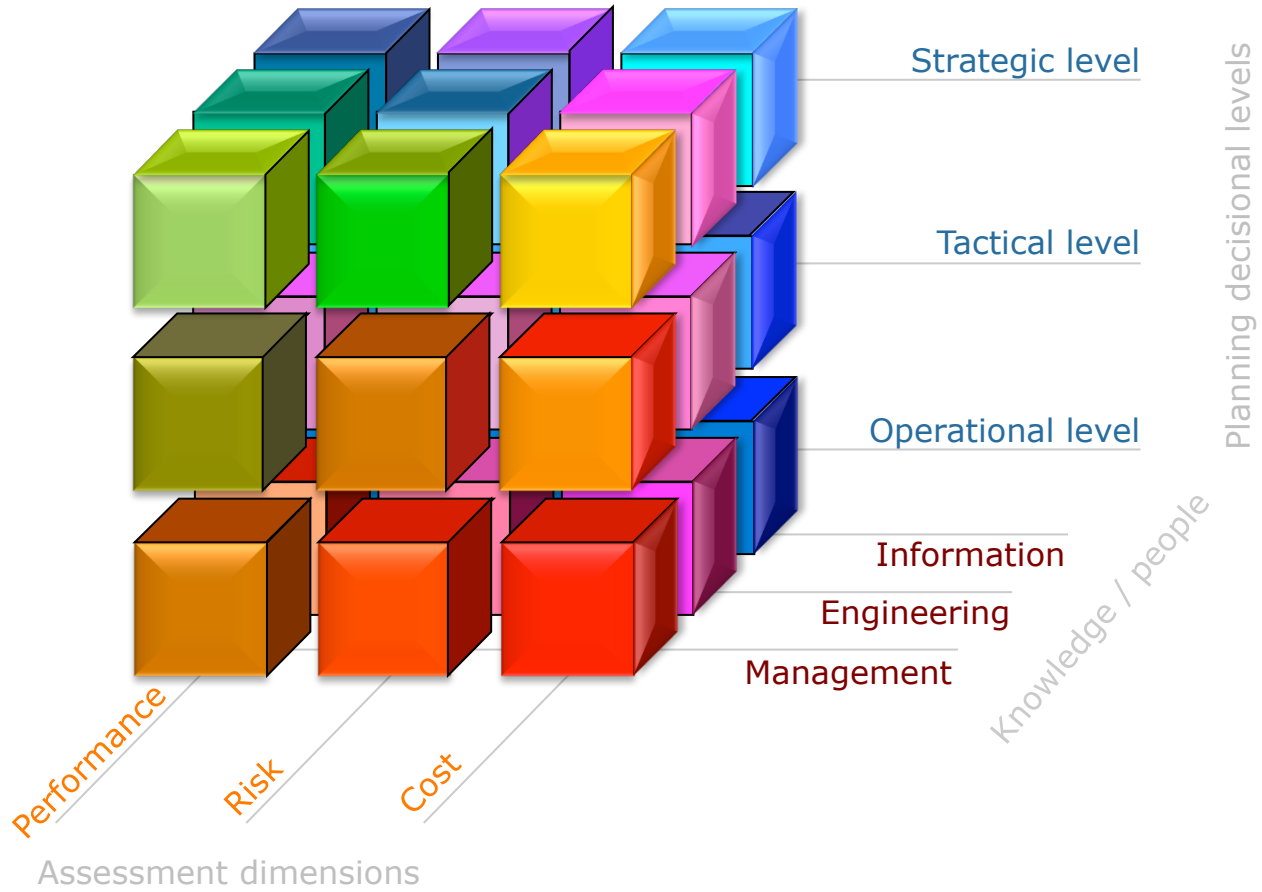
- **Water services** are fundamental to:
  - public health protection
  - population well-being
  - sustainable development of the community
  - environmental protection

- Usually theses services are taken for granted!

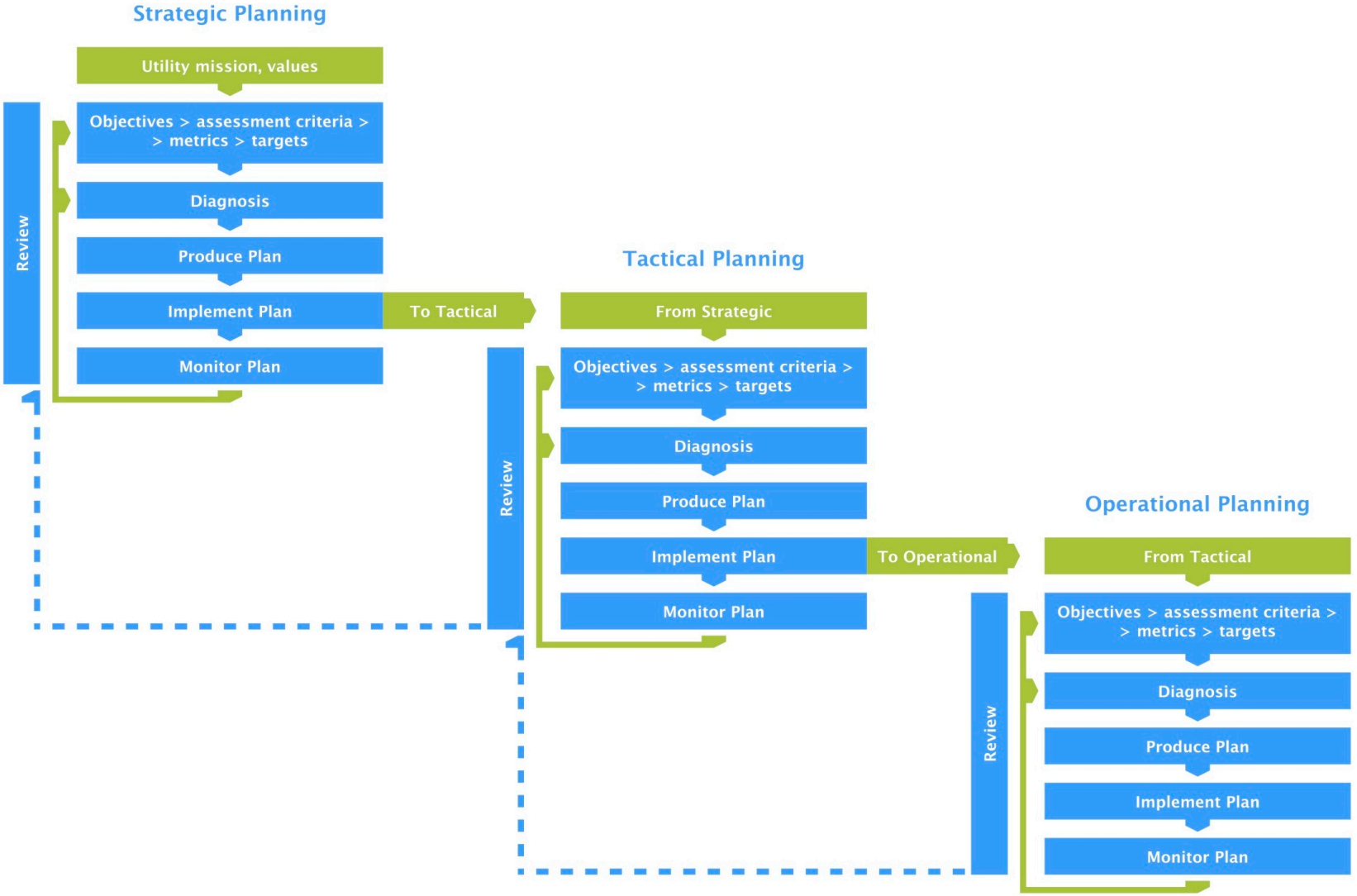
- **Essential**
  - to be rationally and efficiently managed!

AWARE approach

- A strutured and comprehensive procedure for IAM



AWARE approach



Scope & objective

- This procedure has been **applied** by four Portuguese water utilities

- Paper presents an **appraisal of the implementation** of the referred procedure in these utilities:
  - **describing characteristics** of the different water utilities
  - **identifying the major benefits and outcomes** of each developed plan
  - **identifying the main difficulties** that arose from this implementation.

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Case studies

End-user partner		Type of utility	Systems	Pilot study
A	**AGS**, S.A.	**private holding**	municipal concessions from pop. 7,000 to 200,000	"Aguas do Marco" serving 55,000 p
B	**AdP** Serviço, S.A.	part of **AdP Group**	multi-municipal systems	large bulk WWS (700,000 p.) and an industrial WSS
C	**SMAS** Oeiras e Amadora	independent **public utility**	Municipalities of Oeiras and Amadora	pop. 350,000
D	**Veolia** Águas de Mafra	**private operator**	Municipality of Mafra	Pop. 76,000

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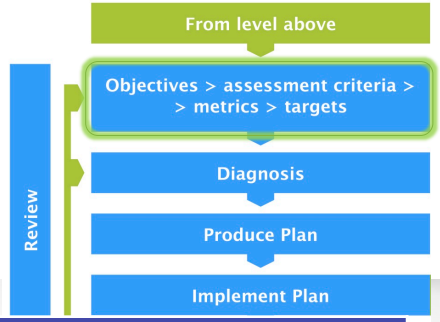
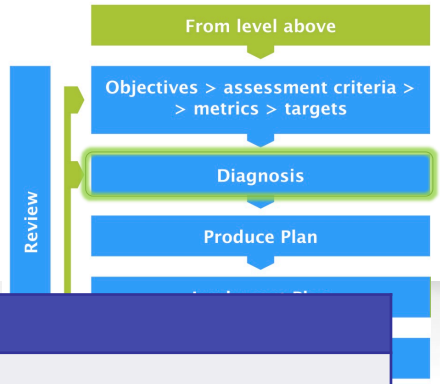
Strategic level results



	OBJECTIVES (using ISO 24500:2007; EN 752 standards; ERSAR quality of service assessment syst											
ASSESSMENT CRITERIA	**Public health and safety**	Meeting user's needs and expectations	Provision of the service under normal and emergency situations	**Sustainability of the undertaking**	Promotion of sustainable development of the community	Protection of the environment	Users interests defence and protection of public health	**Sustainability of the service provision**	Environmental sustainability	Organizational sustainability	**Certification**	Adequacy of the service provided	Assessment of the quality of the service provided
Compliance of all legal requirements concerning public safety and quality for human consumption	A; D												
Service supply failures		D											
Adequacy of the water quantity …			D										
Financial sustainability				B; D				A; C		A			
……	……	…..											
Environmental management systems certification											**A; B**		
Occupational health protection and safety management certification											**A**		

Strategic level results



SWOT analysis

Internal Context

STRENGTHS

- **Good information systems on WSI**
- Sufficient information to assess the water supply systems condition and performance
- **Strong competence** of human resources
- Relation between information systems and work orders

WEAKNESSES

- **Insufficient information systems on WWI** (gaps, inaccuracies)
- **Financial restrictions**
- Inadequate tariffs
- Poor structural condition
- Poor functional performance
- Insufficient historical records
- Inadequate data

External Context

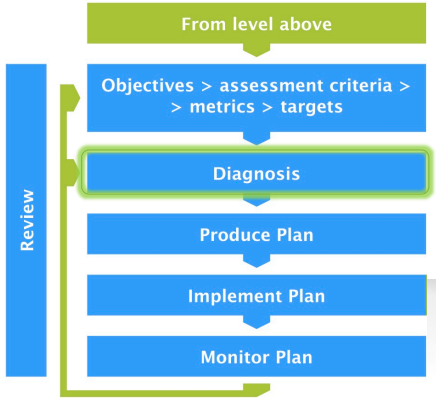
OPPORTUNITIES

- Equipment and technologies available
- **Portuguese regulation and legislation** (improve Qual.Service)
- Incentives for sustainable use of energy

THREATS

- **Portuguese legislation and regulation** (costs)
- Political uncertainties
- Economic crisis and financial restrictions
- Demographic development uncertainties
- Illegal cross connections in wastewater systems

Strategic level results



Main problems identified

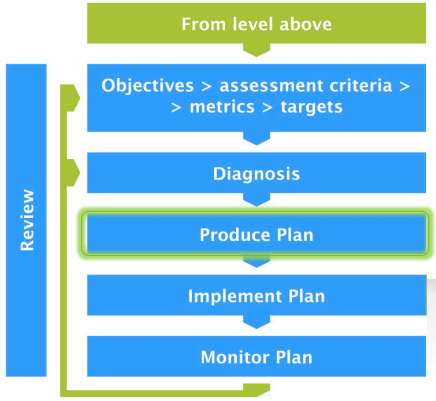
Water Supply

- ✓ **Low system reliability**
- ✓ **Insufficient historical records**
- ✓ Water **losses**
- ✓ Mains' **failures**
- ✓ Insufficient service accessibility

Wastewater

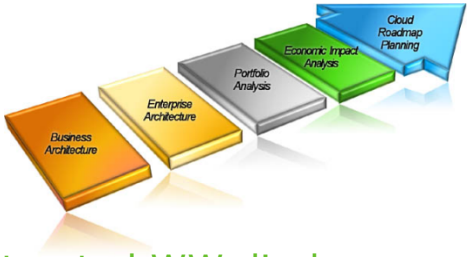
- ✓ **Insufficient / inadequate data**
- ✓ Insufficient historical records
- ✓ **Flooding**
- ✓ **Collapses**
- ✓ **Cross connections** and high **infiltration** and inflows
- ✓ Insufficient service accessibility and coverage

Strategic level results



Strategies (similar for WS and WW)

- S1 - **Protect public health** regarding WS quality
- S2 - **Control water losses**



- S3 - **Protect public health** from untreated WW discharges
- S4 - **Reduce cross connections and infiltration**

- S6 - Improve infrastructures information systems
- S7 - Increase system reliability

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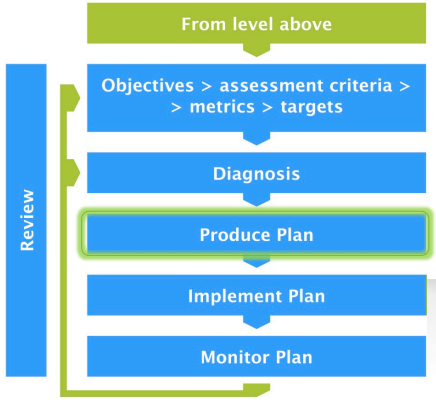
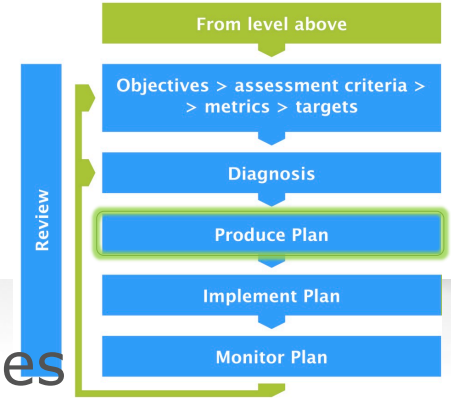
Tactical level results



Type	System reference	Features (physical charactics and population)	Problems
Water Supply 	A-WS1	**Rural**/ peri-urban; 478 customers; 39 km pipe length; 278 service connections	- High water **losses** - High non-revenue water - **Inadequate pressure** - Occurrence of pipe failures
	A-WS2	**Rural**/ peri-urban; 220 customers; 3 km pipe length; 114 service connections	- Insufficient **storage** capacity - High water **losses** - High non-revenue water - Inadequate pressure - Occurrence of pipe failures
	B-WS	**Industrial**; service started 1980; supplied by one 10 km water main; 17 km pipe length; 10^7 m^3/year	- Water **losses** - **Corrosion** in metallic components - Future increase of supply needs - Need for system redundancy
	C-WS	**Urban**; 4388 customers; 12.5 km pipe length; 40% of asbestos cement	- High water **losses** - **Pressure** problems - **Velocity** problems - Pipe failures, mainly in asbestos cement - Service interruptions
Waste water 	A-WW	**Rural**/ peri-urban; 1.1 km^2 catchment area; separate domestic system; 9.5 km sewer length; 280 manholes; 85 customers; 128 723 m^3/year	- **Insufficient** inventory **data** - Insufficient monitoring data - High inflow/infiltration flows
	B-WW	**Domestic** interceptor system; close to coastal bathing waters; 220 km^2 contributing area; 140 km sewer length; 798 000 p.e.; 155 000 m^3/day of collected wastewater; 11 pumping stations;	- **Poor structural condition** of particular sewers - High **inflow/infiltration** flows (mainly received from upstream municipal sewers)
	C-WW	**Urban**; separate system (domestic + storm water); 3.4 km domestic sewer length; 3.5 km stormwater sewer length	- Root **intrusion** - High **inflow/infiltration** flows - **Poor structural condition** of some sewers
	D-WW	**Rural**/ peri-urban; separate domestic system; 360 km sewer length	- Insufficient service physical **accessibility** - Insufficient service **coverage**

Tactical level results



- Commonalities and differences of case studies
  - **Scenarios of evolution** *(relevant changes in the external context)*
    - demand evolution (all)
    - changes in the regulatory system (all)
    - physical access to downstream interception WW services (one)
  - **Infrastructural contexts**
    - mature infrastructures (all), requiring rehab to assure reliable service M&L term
    - some systems in densely populated areas whereas others in peri-urban or countryside areas
    - excessive inflows from stormwater
    - insufficient capacity
    - no redundancy

Tactical level results

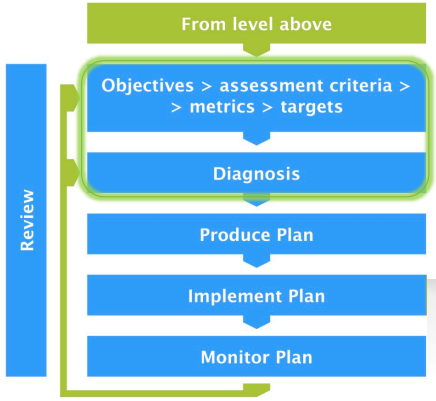
- Commonalities and differences of case studies
  - **Drivers**
    - scenarios
    - infrastructural contexts
  - **Types of decisions required**
    - prioritizing among subsystems for concerted actions
    - detail analysis of parts of the systems
    - application of the whole process

These differences led to distinct paths!

Tactical level results

- System assessment and selection of priority areas
  - tactical objectives, assessment criteria and metrics were defined in alignment with the outcomes of the strategic plan
  - these were applied to each system
- Analysis horizons
  - Most operators considered **20 years**
    - except those with concession >> the last year of concession
- Tactical planning horizons
  - **2 to 5 years**

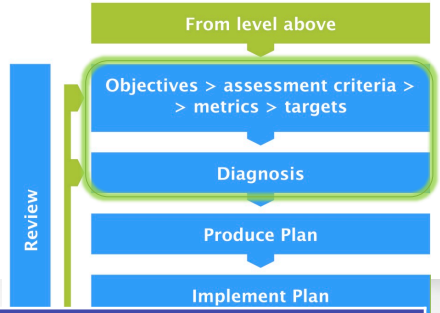
Tactical level results

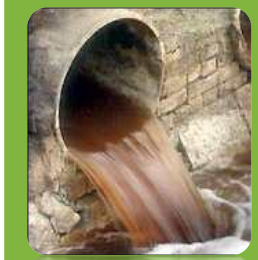


- Detailed diagnosis based on:
  - available data:
    - GIS
    - billing systems
    - complaints & work order record
    - systems telemetry
    - hydraulic models
    - performance indicators
    - accounting data

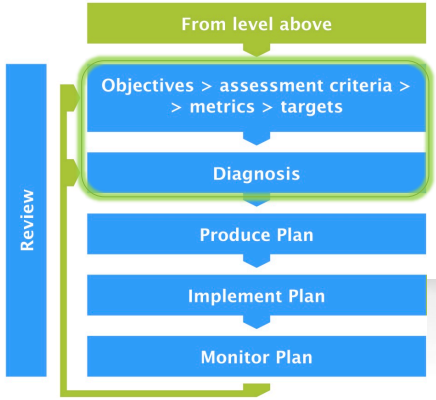
  - C-R-P assessments using established metrics

Tactical level results



	Scenarios	Alternatives
Water supply 	- **Current situation** (e.g. consumption) - **Domestic consumption changes** based on expected population evolution - Consumption defined in the concession contract - Consumption considering commercial development - **Industrial consumption changes**	- **Status quo** - **Pressure reduction** on the network - Improvement of **operation practices** - **Pipes** with higher failure rates **replacement** - Construction of **new pipes** to ensure systems reliability - **Optimal design** in term of cost and energy
Wastewater 	- **Current situation** (e.g. rejection, infiltration) - **Rejection evolution** based on expected population evolution - **Reduction of illegal cross connections and infiltration / inflow** - Completion, during the next years, of treatment and interceptor works that are the responsibility of another operator, but affects the coverage and availability of the service provided	- **Status quo** - **Pipes replacement**. - **Pipes renovation**. - Reduction of a number of cross-connections in separate systems. - Improvement of operation and maintenance practice - Construction of alternative solutions for treatment and connections to the interceptor system where it is available.

Tactical level results



- *Assessments and multicriteria analysis*:
  - the balance between the assessments P, C, R
  - not all assessments were used
    - in A-WS1 and A-WS2, the main assessments were P+C
    - in B-WS and D-WW cases, the main assessments were C+R
  - the **cost** is always relevant for all operators
  - evaluation and ranking of alternatives
    - See Marques *et al.* (2011)'s presentation
    - See Carriço *et al.* (2011)'s presentation

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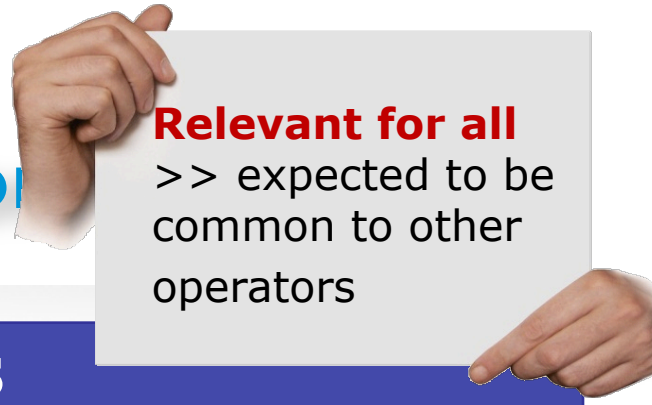
Benefits of IAM implementation



SWOT analysis

Strengths

- AWARE-P project partnership
- Development of an IAM plan
- Availability and experience on information systems
- **Knowledge improvement on IAM** by participating on the project
- Results and opinion sharing with other utilities
- Promotion of internal procedures changes
- Improvement of infrastructures knowledge (e.g. inventory data collection)
- Improvement of infrastructures condition and functional information (e.g. infrastructure condition, monitoring)

Weaknesses

- Insufficient integration between different organizational levels (e.g. decision, technical, operational)
- **Poor availability of data** specially in wastewater systems which affects C-P-R assessments
- Poor information on systems reliability (e.g. failure data, historical records)
- Poor quality of data
- Limitations in existing information systems
- Difficulty in alternatives design and analysis
- Financial constraints

Opportunities

- **The new Portuguese legislation** (DL 194/2009) **and regulation** (made by ERSAR)
- Availability of new developments in IAM planning
- Availability of new developments and technologies
- Existence of a concession contract
- Higher requirements of customers on the service provided
- Need to improve infrastructure data and information

Threats

- Lack of specification, in the Portuguese legislation, on what is IAM
- **Significant effort and human resources were required** for the implemention of IAM planning methodology
- Investment restriction of concession contracts (low investment flexibility)
- Financial restrictions, Political uncertainties, Economic crisis

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Conclusions

- **Application** of the AWARE-P IAM methodology
- **End-users**
  - represent a significant variety of institutional /organizational formats, priorities, drivers
- **Good evidence**
  - that the methodology provides a standardised and flexible IAM planning framework

Conclusions

- **Strategic management level**
  - the need to revise stated objectives and strategies
  - the importance of carrying out a systematic and organised diagnosis
- **Tactical management level**
  - the most critical step is in generating meaningful and comprehensive alternatives
  - the need to integrate performance, risk and cost assessments

Conclusions

- Recently changed Portuguese regulatory framework in terms of IAM is an **opportunity** to improve data and knowledge
- Despite the considerable effort and resources needed to apply the AWARE approach, utilities have now the **knowledge and new tools** to develop their own plans**!**