



Where to apply Data Analytics in Water Utilities?

An exhaustive cases list where Data Analytics application could have a higher impact on Water Industry Digital Transformation

URBAN CYCLE

- Resource (collection and production)
- Drainage
- Water supply (transport and distribution)
- Waster water

TECHNICAL AREA

- Asset management
- Operation and maintenance (O&M)
- Project management and capital investment

COMMERCIAL AREA

- Billing cycle
- Metering and reading
- Customer care

Resource management (Collection & Production)

¿WHAT HAPPENED?

WHY IT HAPPENED?

WHAT WILL HAPPEN?

WHAT SHOULD I DO?

Quantification of water sources

How much water is available in our sources?
 What's the trend? Goes up? Down?
 Is it higher or lower than expected at this season? Is it anomalously low or high? How much?

Quantitative and qualitative prediction of water sources

Am I facing an extreme event? A drought? A pollution episode? Floods?
 What symptoms can advise me?
 What gravity level is expected?
 What will be the availability by source in those cases?

Alternative sources analysis and benchmarking

What's the long-term water demand forecast?
 How can I minimize the impact of an extreme event that reduce my current water sources availability?
 When should I start acting? What factors or parameters should advise me?
 How should operational, economic, environmental, or demographic factors be combined?

Qualitative analysis of water sources

What is the qualitative state of our sources?
 Which source is worse than others? Which are the wrong parameters?
 Are they below any quality standards?
 Has water quality been progressively lowered or are just specific outlets? In which periods does it normally happen?

Water collection economic optimization

What's the water collection associated cost? Is it going up or down?
 What is the ratio between internal and external sources?
 How does it impact on the overall exploitation? When should I do something to counteract a negative impact?
 What's the optimal combination point to be sustainable?

¿WHAT HAPPENED?

Analysis of drainage network condition

Where do I have more problems on the network?
What is the relationship between water blockage, storm events and network cleaning rate? Is it direct or indirect? Is it quantifiable?
How often I execute cleaning operations on the net? Where am I concentrating my efforts?
What's the relationship between maintenance operations and the rate of blockages in the network?
How is affecting the "baby wipes" toilet epidemic? Can I demonstrate its negative impact, evolution and quantify it?

WHY IT HAPPENED?

Network condition forecasting

According to the network condition, Where do I envisage having more blockages and overflows?
How the risk is distributed along the network?
How should I prioritize my cleaning plan to minimize this risk smartly?
Am I ready to take on these changes in my daily operation?

WHAT WILL HAPPEN?

Operation simulation to correctly face severe events

Where should I place my storm tanks? How should they be built in order to minimize the risk to minimum acceptable according to probability and impact?
Are there any alternative actions we can take before that option? How does it affect my network?
According to historical data, how often do I expect these events?
What is the forecast for the next event?

WHAT SHOULD I DO?

Storm operation strategy optimization

What are the thresholds to start acting in case of severe rains?
How should I deal with these types of alarms?
Is my operation ready for it? What changes should I make?

Water supply (Transport & Distribution)

¿WHAT
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SHOULD I
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WDN performance analysis

What's my WDN performance? How is it distributed by DMA?

How has it evolved over time?

Do I have a real benefit if I get it every day? And what about hourly?

Water demand forecasting

How much water should I produce in the short term? And mid-term?

How do the different factors affect this forecasting? Is it reliable? How can I increase that reliability?

What's the water production entire cost? May I minimize this cost without impacting service guarantee or environment?

Water loss reduction and leak detection optimization

Where are the places most likely to suffer a water leak? When do they get used to producing? Under what circumstances?

According to WDN performance evolution, where should I focus to reduce technical losses?

How should I change my strategy to maximize leak detection?

From what economic, environmental or operational perspective should I prioritize this strategy?

Network condition impact analysis over water service continuity

Where and at what time are breakages and breakdowns concentrated? And planned cut-offs?

How do both types of problems affect the service? How have they evolved?

How can I minimize this condition? What alternatives can I use in waterlocks?

What type of breakdowns affect the most? How am I responding to these? And preventively?

Water quality analysis

Are we strictly complying all sanitary regulations? Are any warning quality alert in short-term?

How does water quality evolve along the network? Are there any trend I need to be worry about?

What is the evolution of Water mixture over the network?

WDN qualitative condition forecasting

According to network monitoring, where am I most likely to have chlorine problems?

When do these conditions usually occur?

What's the short and medium term event forecast?

How can I react to minimize the risk?

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WWTP operation analysis

What are the KPIs that better monitor my WWTP operation?

May I characterize the depuration process performance with these indicators? How should I combine them?

How do these indicators evolve? What trends do I observe?

What's the environmental impact of my malfunction?

Effluents qualitative condition forecast

What's the effluent quality that I'm returning to the environment? How has it evolved? Better? Worse?

The relationship between process used, chemical reagents usage and the effluent, may I model it correctly?

What's the proportional impact of my effluent on the natural environment condition? And taking into account other impacts?

Treatment cost comparative analysis and optimization

How should I modify my treatment processes to optimize the entire cost?

Where are the biggest deviations? Do it have a process component? Geographical maybe?

Reuse rate analysis

What's the ratio between produced, purified and reused water? How does this ratio evolve?

Do they match up correctly with my usage planning? Am I deviated from what I planned? Why?

What's the additional cost incurred by the reused water related to the purified water?

WW network overflows analysis

Where are the overflows concentrated in time?

Under what conditions have they occurred? What factors can explain them better? Constructive? Weather?

Is there any temporal or spatial pattern that can explain them?

Pollutant load forecasting

According to my sewage network topology, where's the pollutant load concentrated?

How will evolve facing behavioral and structural changes in the Smart city?

How should I adapt my chemical and operational processes to those changes?

Water pollution events analysis

When do I usually fail to meet international and national quality standards thresholds?

What factors are most relevant in order to breaking these? What was the reason?

Are all factors I can control directly? What are the indirect ones? How much do they contribute?

Asset Management (I)

¿WHAT HAPPENED?

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WHAT SHOULD I DO?

Advanced asset condition evaluation

What percentage of assets are in good condition?
What about poor ones?

How does the asset condition rate evolve over time?

Is there any obvious geographical pattern? Is there any relevant hot spot?

Does my maintenance strategy fit the asset condition reality and its evolution?

Asset remaining useful life analysis

What's my assets remaining useful life? How is this useful life distributed?

How does it relate to its characteristics? And with the manufacturer? And with other external or indirect factors?

Am I maximizing this life span with my maintenance strategy? Should I change it? How?

Asset deterioration modelling

While our are deteriorating in one way or another, how should I adjust the maintenance?

How long is the asset expected to last?

How will it affect its degradation to other assets?

What's the relationship between space and time in these models?

Corrective actions and measures analysis

What types of assets have more breakdowns? Which have worse ROA?

Which have exceeded the average reference cost?

What economic impact are these actions assuming? Over OPEX? What about CAPEX?

How can I prioritize troubleshooting according to different strategies (environmental, service, economic ...)?

Asset operation analysis and diagnostic

Which assets are operating anomalously? Where they are located?

What's the relationship with the environment? How often are they failing?

What behavior or trend is observed before the malfunction alarm?

What asset types have the longest malfunction? How does it affect the service? Can I quantify it?

Asset suppliers analysis

According to asset typology and condition, which are the suppliers that work best for me?

What are its devices with better performance rate?

Do these suppliers respond properly in front of failure events?

Which are the most recommended according to my current maintenance strategy? And in the future?

Asset management (II)

¿WHAT HAPPENED?

Preventive maintenance analysis

How effective is the preventive maintenance applied in my strategy? Which is the relationship with the damages I suffer?

What's the optimum application point in time and space of this maintenance type?

What proportion of preventive I'm applying in my strategy? How is it evolving with respect to others?

WHY IT HAPPENED?

Reliability analysis and forecasting

What's my assets availability (without failures) average time?

Where do I have my assets malfunctioning much time?

Is there a common pattern between assets and fault frequency?

How the different assets are influencing each others (Fault Tree)?

WHAT WILL HAPPEN?

Predictive maintenance

What is the optimum time to replace the asset?

When should I go to perform an asset maintenance? What tasks should I perform?

What assets would fail in case of sudden pressure boost? Which are the least reliable?

Is there a real economic and operational benefit using this strategy? May I quantify it?

WHAT SHOULD I DO?

Risk analysis and prediction

Which are the assets that most serious accidents have caused?

Which is every asset's failure impact on the service? And the probability?

How are the impact and probability distributed along the network? Where's the worst fail scenario? How often can it happen? Where should I act first then?

How can I make to be advised prior to the event?

Maintenance optimization based on risk and reliability

Which is the maintenance strategy that minimizes the failure time to the max?

And which one reduces the risk in different networks to the maximum?

What's the economic impact over operation?

Operation and maintenance

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SLAs analysis

Do subcontracted service providers meet my SLAs?
Who's suffering deviations? Under what conditions or WO types?
How do these deviations evolve? Can I identify any temporal or spatial patterns?
Who are the best suppliers? Is there any that fits better to WO type, DMA, zone or other relevant factor?

Global operation awareness

What are the average response and resolution times by WO type? Do I achieve what I have established as correct?
What are the indicators that best monitoring my operations? Where and when should I apply them to be more efficient?
Are resources distributed correctly across the territory according to my maintenance strategy?
What's the specific weight of each WO typology on the entire operation? How does it relate to my network condition

Operational simulation and optimization

How can I make a smart tasks dispatching? What are and how should I combine the factors (geography, skills, resources location and volume...)?
What strategy should I use to minimize the impact on the service? And to get the most economic efficiency?
How will the water service quality evolve according to strategy?
What does the application of these strategies mean in terms of resource needs?
Can I segment optimization by facility type?

Safety operation analysis

Which are the most common accidents registered? Where and when do usually they occur?
How does the accident rate evolve?
What's the direct cost of non-security? And the indirect?
How many of these accidents are suffered by people working alone? What's the average warning time in these cases?

Operational accident rate forecasting

What's the relationship between the claims map and the asset risk map? Is there direct causality?
What's the relationship between the preventive measures, available resources and observed accidents?
How does the blue collars training and skills affect registered casualties number and distribution?
What internal and external measures can I take to reduce injuries probability? How should I apply them?

Project management and CIP (capital investment planning)

¿WHAT HAPPENED?

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ROI analysis

Which projects are I investing in? Am I doing it according to my established plan?

What's the expected impact of these interventions? How can I measure and follow that impact?

Are there deviations of any kind in the projects? What are the reasons?

What kind of projects do they deviate the most? What are the factors that most influence on these deviations?

Environmental cost evaluation and prediction

Based on my current investment and operating plans, what's the environmental cost I have? And my carbon footprint?

How will this evolve regarding the strategies proposed on my plan?

How can I reduce impact with minimum economic cost?

Priorización de inversiones

Depending on different network risk distribution and condition, where should I invest the next few years to make the most with my available financial resources?

How should I plan works to obtain the maximum return and benefit to guarantee the water service maximum level?

Which is the influence of a CAPEX proportional increase over the benefits?

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Account analysis

Who's behind the contracts? Who's really my client?

Can I segment my client based on the information they're providing me? Do we have enough data to do that?

How are my customers divided by usage? And according to the different typologies that I've created?

Where are the most critical ones? Are they well protected?

Non-payment reduction and analysis

Where and when is the bill non-payment concentrated? Who is affecting mainly? Can I correctly characterize the subscription type?

Is there a relationship between the service condition and non-payment?

Is non-payment predictable? How will it evolve in the future?

How should I adapt my customer relationship to reduce debt and helping them at the same time?

Anomalous consumption and fraud forecasting

What is the standard consumption pattern of each subscriber? Can I detect anomalies?

Is the anomaly a technical problem or a fraud?

Do I need to go and inspect it? How does the inspection volume affect my daily operations? May I reduce the number?

Which is the impact of the "anomalous consumptions" over the entire registered consumption?

Billing forecast

What's the expected current period turnover? And for the next one?

What number of additions and withdrawals may I anticipate in the future?

Can I segment it for special uses or tariffs?

Is there any obvious trend in that evolution? Should I take any special action?

Billing process optimization

What error rate can I expect for the current billing process? Is it increasing or decreasing over time?

Where are these errors concentrated? What impact do they have on the billing operation?

How do they relate to operational aspects? And with the metering process?

How can I reduce the error rate before launching the billing process?

Tariff simulation

How can I structure my tariff to ensure the highest service quality while minimizing the impact for the customer?

What different alternatives may I check?

What are the factors that I can handle to build it?

Metering (I)

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Water consumption analysis

How is the water consumption distributed geographically and temporary along the net? Where's the demand concentrated?

What are my target clients? How can I characterize their behavior and group them?

How is water consumption currently distributed among these groups? And how will be in the future?

What's the average consumption per capita? And by neighborhood? And by type?

IoT sensors strategy analysis and comparison

Depending on my IoT sensors strategy, which sensors should I buy?

What tests should I do before making the purchase effective? May I use installation historical data to reinforce the process?

What factors are most relevant when making the purchase decision? Can I change them?

What's the estimated investment for the coming years?

Meter inventory optimization

How can I fit meter typology and characteristics to my customer use and typology to maximize its technical performance?

How often should I change the customer meter?

How can I optimize the purchase of devices to fulfill my strategy requirements?

How may I plan a replacement campaign to maximize operational efficiency?

Data collection provider analysis and recommendation

How is the manual metering process distributed? Where are the worst success rates?

What's the cost associated with inspections of each manual metering supplier?

What's the quality services KPIs forecast? Should I take any decision in short-tem?

According to my meter strategy, is there space for improvement in the process of assigning metering routes?

Smart metering adoption analysis

What's the current smart metering deployment?

Is it working correctly? Is the service acceptable?

What use am I doing to available data? Can I easy calculate the smart metering ROI?

How can I increase it?



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Measurement error rate forecasting

What's the current average error rate in the measurements obtained? Is it increasing or decreasing over time?

What impact does it have on operation and maintenance? Is the associated performance acceptable? When should I take action to address it to acceptable levels?

According to the deployment and replacement strategy, what error forecasting will I have in the future?

Are they calibrated correctly? How should I do to ensure the right data quality

IoT sensors location strategy optimization

In order to maximize ROI and ROA, where should I have to install sensors along my networks? And in my plants and other facilities?

How should I progressively applying this sensing strategy? How many phases should I execute?

What type of assets should I monitor first? And subsequently?

What's the impact on my capital investment planning?

Meter data collection methods comparative analysis

What types of metering method am I using? What performance and derived service quality do I get from each one currently ? And what is the expected evolution?

Have I optimized the manual metering process by smart task dispatching? Do I have space for improvement to apply it?

When does it make sense to switch to smart metering?

What's the business case that could optimize my meter operation using different methods? Which is the right plan to start with?

Data collection process optimization

How often am I collecting meter data manually? Is this process planned efficiently? May I do better?

What's the cost of the associated inspections after each data collection campaigns? Is it high compared to entire process?

What would be the impact if I change the data collection plan? In short-term? And what about mid-term?

What's the cost over customer satisfaction of this disruptive change? How should I modify my tariff structure to minimize it?

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Customer care service analysis

How am I relating with my customers? And with those who are still not?

What are the most accepted communication channels? How much do people use each channel? To do what?

Do we respond well on time and correctly? Am I doing it right or the service is every day worst?

Are my clients happy? How can I know that?

Multi-Channel customer service model optimization

How should I change to adapt the way I communicate with my customer expectations?

What other channels may I use? Which are the best that fit my reality? And customer's reality?

How can I make this transformation without a negative impact to the service?

What's the expected economic? How does that fit into my CIP?

Behavioral segmentation

Regarding water consumption, what's the behavior of each of my customers and how is he connecting with me? Can I group them?

How should I approach each of these groups in order to increase their satisfaction?

What actions and channels should I use?

What kind of recommendations can I make?

Customer satisfaction forecasting and optimization

According to the contact historical data, how should my customer perceive us?

How do affect network condition, service affections and other operational aspects in their mood about us?

Can I find out their mood during calls using cognitive services (voice)? Or by what it says in social networks?

What are the recommended actions I can take to make my customer happier?