

Eesti Keskkonnauuringute Keskus

Evaluation of treatment efficiency of wastewater treatment plants, constructed and reconstructed in 2004-2014, using grants by EU and EIC



Situation in Estonia

- In total there are ca 700 wastewater treatment plants in Estonia
 - 242 WWTPs have been constructed or reconstructed between 2004 and 2014 using grants by EU or Environmental Investment Centre
 - More than 1 000 000 000 EUR has been invested into 288 WWTPs during that period

But...

- According to national monitoring programs about 50% of WWTPs are not capable to meet environmental requirements
- According to self-monitoring programs about 10% of WWTPs are not capable to meet environmental requirements most of the time



Evaluation of treatment efficiency of wastewater treatment plants, constructed and reconstructed in 2004-2014, using grants by EU and EIC

Purpose of the project:

- Evaluation of efficiency of WWTPs
 - What are the common mistakes?
 - Recommendations and guidelines
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- Deadline september 2015

Parties involved



- Ministry of Environment
- Estonian Environmental Research Centre
- aqua consult baltic OÜ
- Estonian University of Life Sciences
- Entec OÜ
- AS Infragate Eesti
- University of Tartu
- Republic of Estonia Environmental Board
- Estonian Waterworks Association
- Estonian Environment Agency
- Environmental Investment Centre



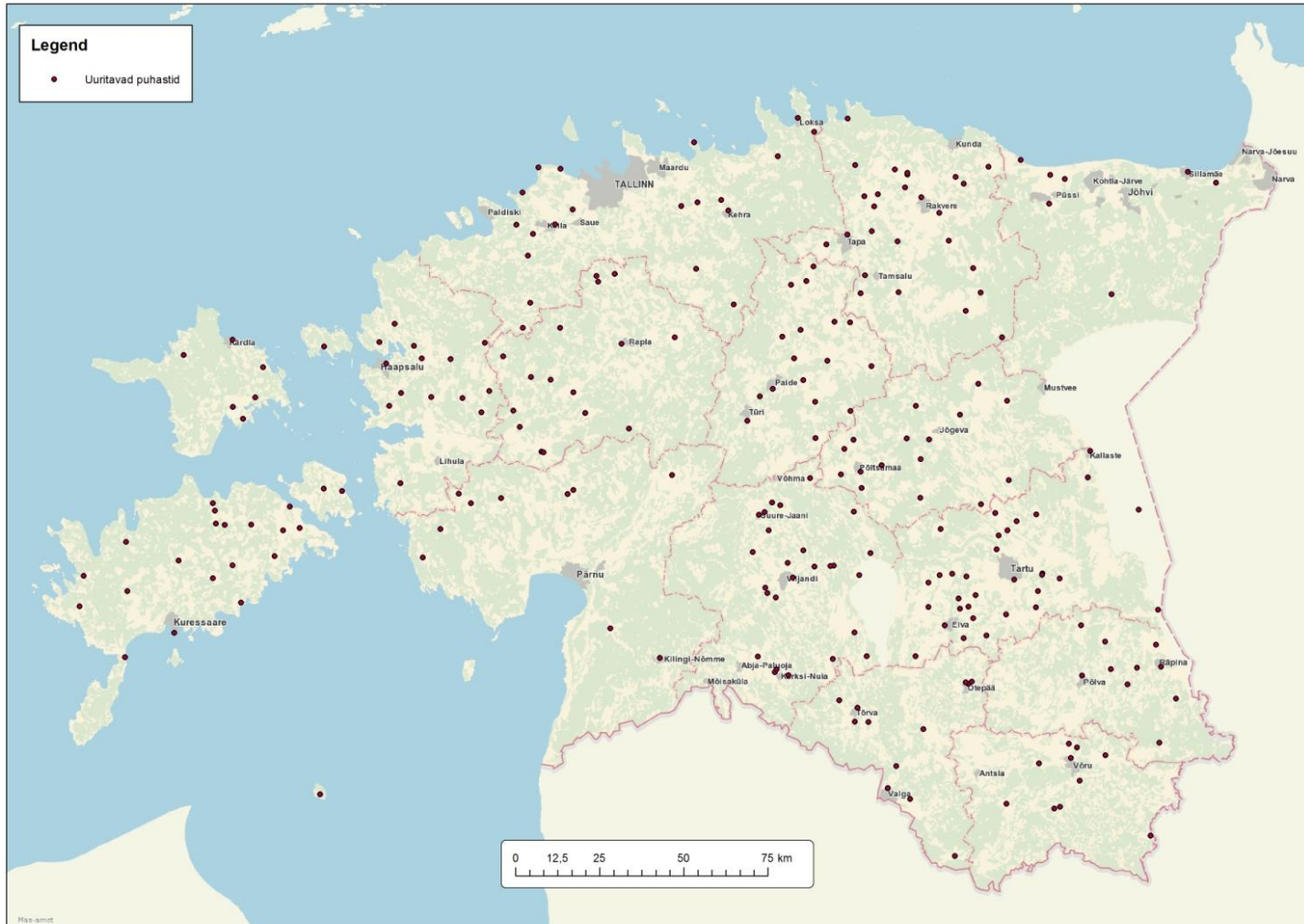
Evaluation of WWTPs

- I phase – evaluation and data collection
 - Methodical approach
 - On site data collection
- II phase – statistical analysis and recommendations
 - Statistical analysis
 - Case studies and reasons for malfunction
 - Recommendations for unsuccessful WWTPs
 - Guidelines for next funding period

Phase I

- Integrated method for evaluation of different wastewater treatment technologies was developed
- 245 WWTPs had to be visited and evaluated on site
- Questionnaires for water companies
 - Finances, investments etc

WWTPs



Method

- The aim of integrated method for evaluation of different WWTPs was to create comparable system of ratings for all technological solutions
 - All different stages (screens, septage tanks etc) of WWTP were examined individually
 - Summary of evaluation was formed from the grades of different stages

Parts of the evaluation

- **Complexity** - how complex is the technology used?
- **Effectiveness** – how well is it working?
- **Operator** – how well does an operator know the plant he is responsible for?

Complexity

- The purpose is to compare different technologies
- The aim is to create a comparable scale for different wastewater treatment plants
- Complexity describes on the scale 0-10
 - How many different stages are used
 - How complex are these separate stages

Effectiveness

- Effectiveness surveys all these factors that might affect proper work of the WWTP:
 - Malfunction of the equipment
 - Operational and maintenance issues
 - Settling problems
 - Etc
- Effluent analyzes are also included to the evaluation of effectiveness



Evaluation of WWTP

Complexity

Effectiveness

General complexity

Defines phases of WWTP to be evaluated

Weighted complexity of WWTP

Effectiveness of phases in WWTP

Weighted complexity of wastewater treatment

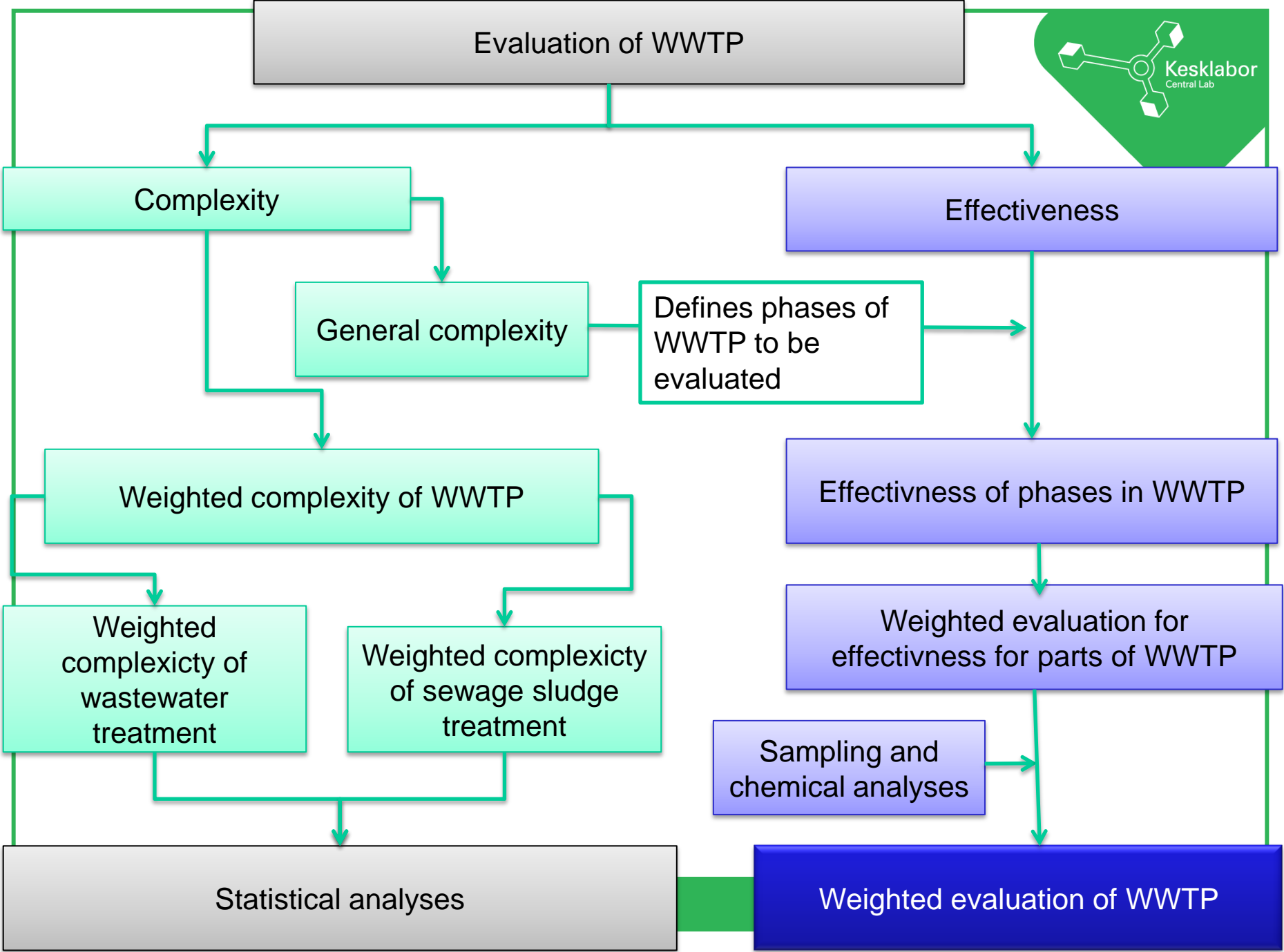
Weighted complexity of sewage sludge treatment

Weighted evaluation for effectiveness for parts of WWTP

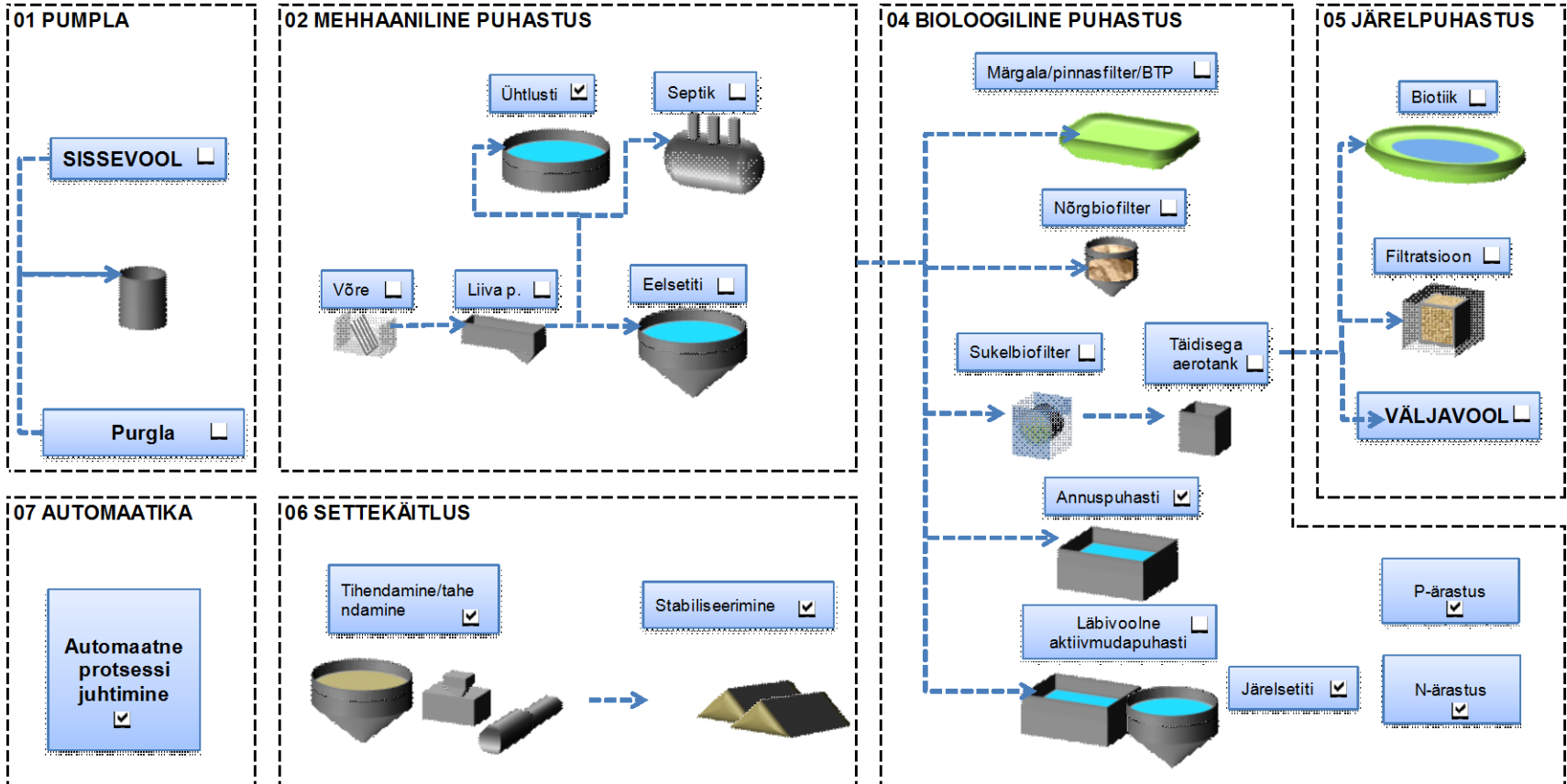
Sampling and chemical analyses

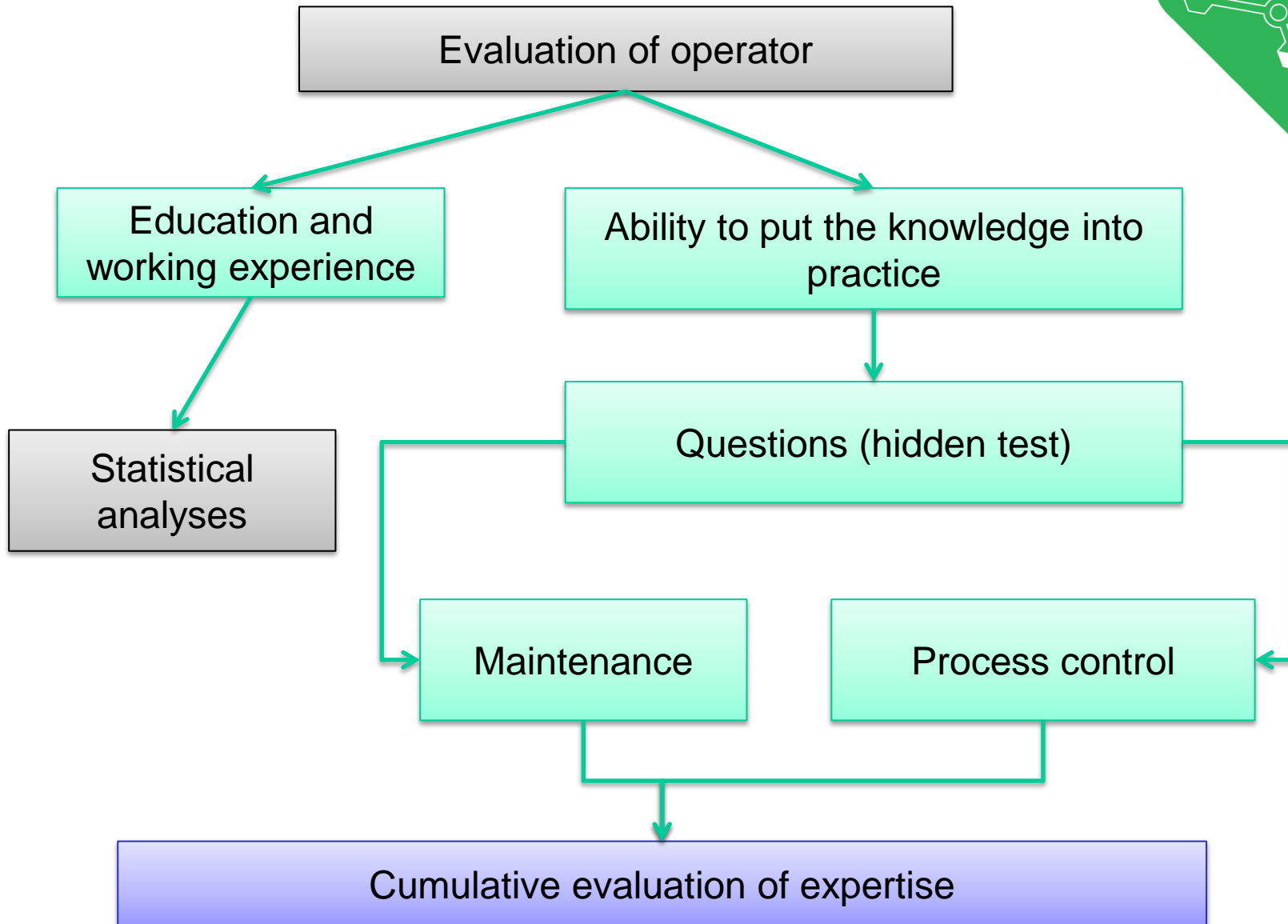
Statistical analyses

Weighted evaluation of WWTP



Method for evaluation





Formation of evaluation

Komplekssus kumulatiivselts	Punkte	KAAL	KAALUTUD
10 PALLI SKAALAS	1. $\frac{\sum_{i=1}^n X_i \times Y_i}{\sum_{i=1}^n Y_i} \times 10$	$\sum_{i=1}^n Y_i$	$\sum_{i=1}^n X_i \times Y_i$
Parameeter 1	0	4	0
Parameeter 2	1	3	3
...
Parameeter _{n-1}	X _{n-1}	Y _{n-1}	X _{n-1} × Y _{n-1}
Parameeter _n	X _n	Y _n	X _n × Y _n

- Adjusted scale from 0 to 10

Results so far...

- 233 WWTPs have been evaluated
 - 8 more to go
 - 4 WWTPs did not receive any money
- All WWTPs had problems
 - 76 WWTPs did not meet the effluent quality requirements
- In general the methodical evaluation agrees with analytical results

Setbacks

- Not all the water companies are cooperative
 - Finances
 - Projects
 - Other data
- Several working versions of Excel
- Method for evaluation needs to be adjusted

Problems with WWTPs

- Main reasons for malfunction:
 - Infiltration
 - Operational problems
 - Foaming and bulking
 - Unsuitable projects and/or technology
 - Etc.....

Design and construction

	No of occasions	%
Design and construction		
Designing of WWTP was done without actual loading measurements	113	48,29%
Equipment on site is different than designed	3	1,28%
Installation of equipment or facilities is inadequate	30	12,82%
Indoor ventilation is inadequate	5	2,14%

Operational limitations

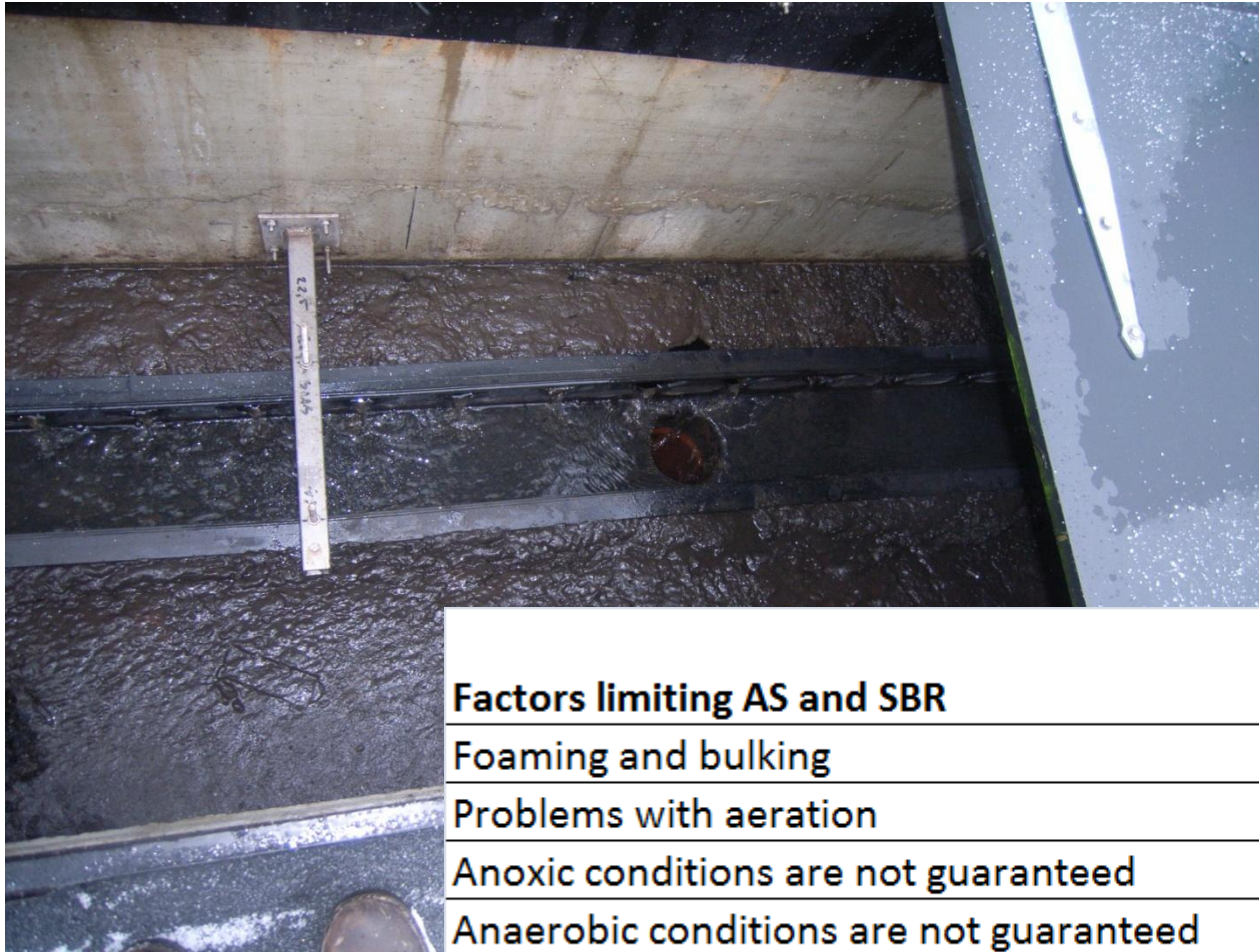
Factors limiting O&M	No of occasions	%
The process is partially visible	12	5,13%
The process is not visible	53	22,65%
Access to the facilities is limited or absent	20	8,55%
O&M manual is absent	22	9,40%
O&M manual is not about the process	33	14,10%
Not enough finances for regular maintenance	6	2,56%
Operator does not know how to make changes in the process	13	5,56%
Heavy shutters are limiting O&M	6	2,56%
Power failures	11	4,70%
Freezing and glaciation	6	2,56%
Equipment failures	27	11,54%

Problems with influent



Limiting factors	No of occasions	%
Changes in Q more than 50%	126	53,85%
No bybass	52	22,22%
Problems with industrial waters	172	73,50%

Foaming and bulking

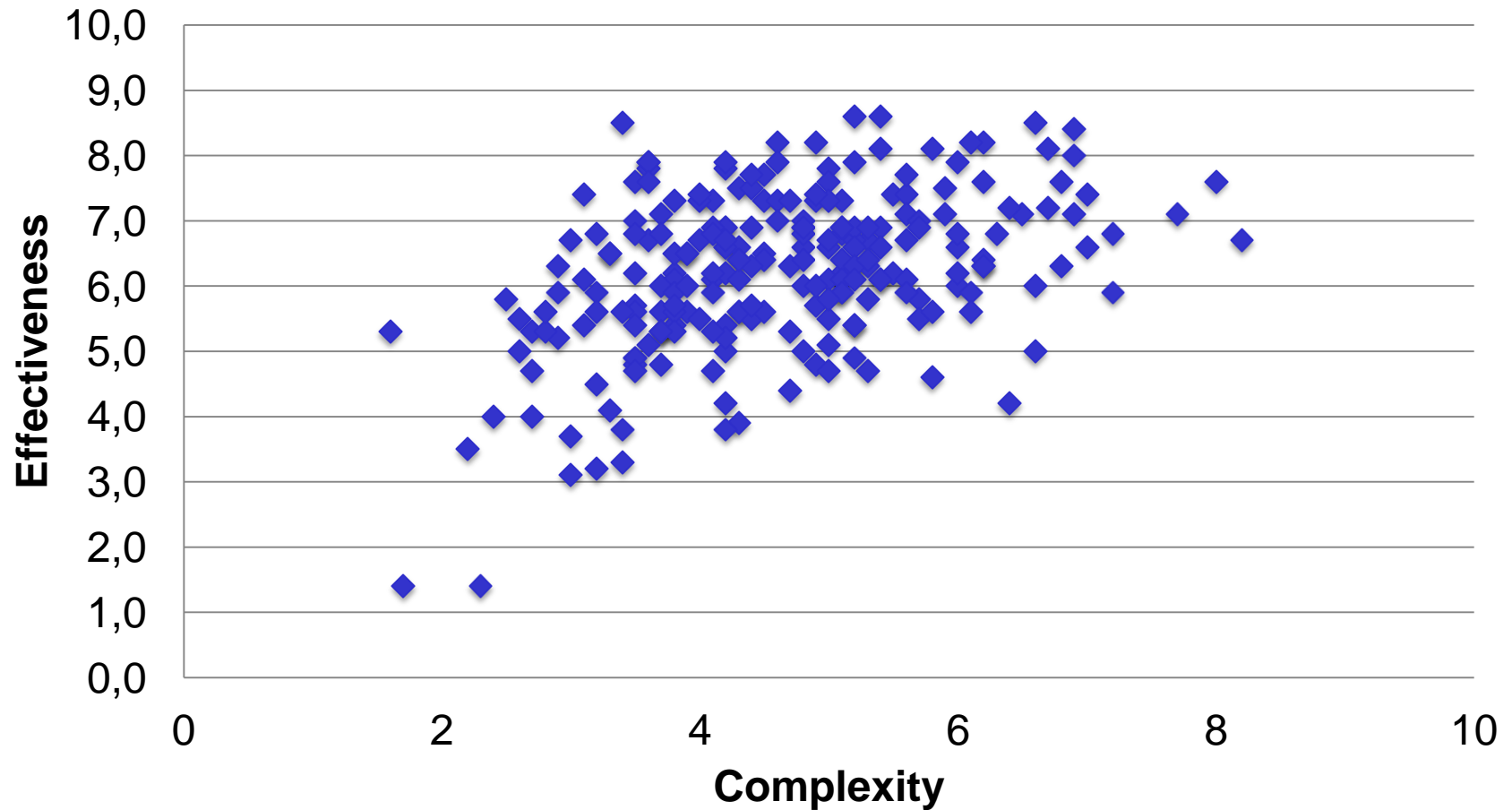


Factors limiting AS and SBR	No of occasions	
Foaming and bulking	36	15,38%
Problems with aeration	35	14,96%
Anoxic conditions are not guaranteed	22	9,40%
Anaerobic conditions are not guaranteed	8	3,42%
Operator does not adjust SRT for cold period	32	13,68%

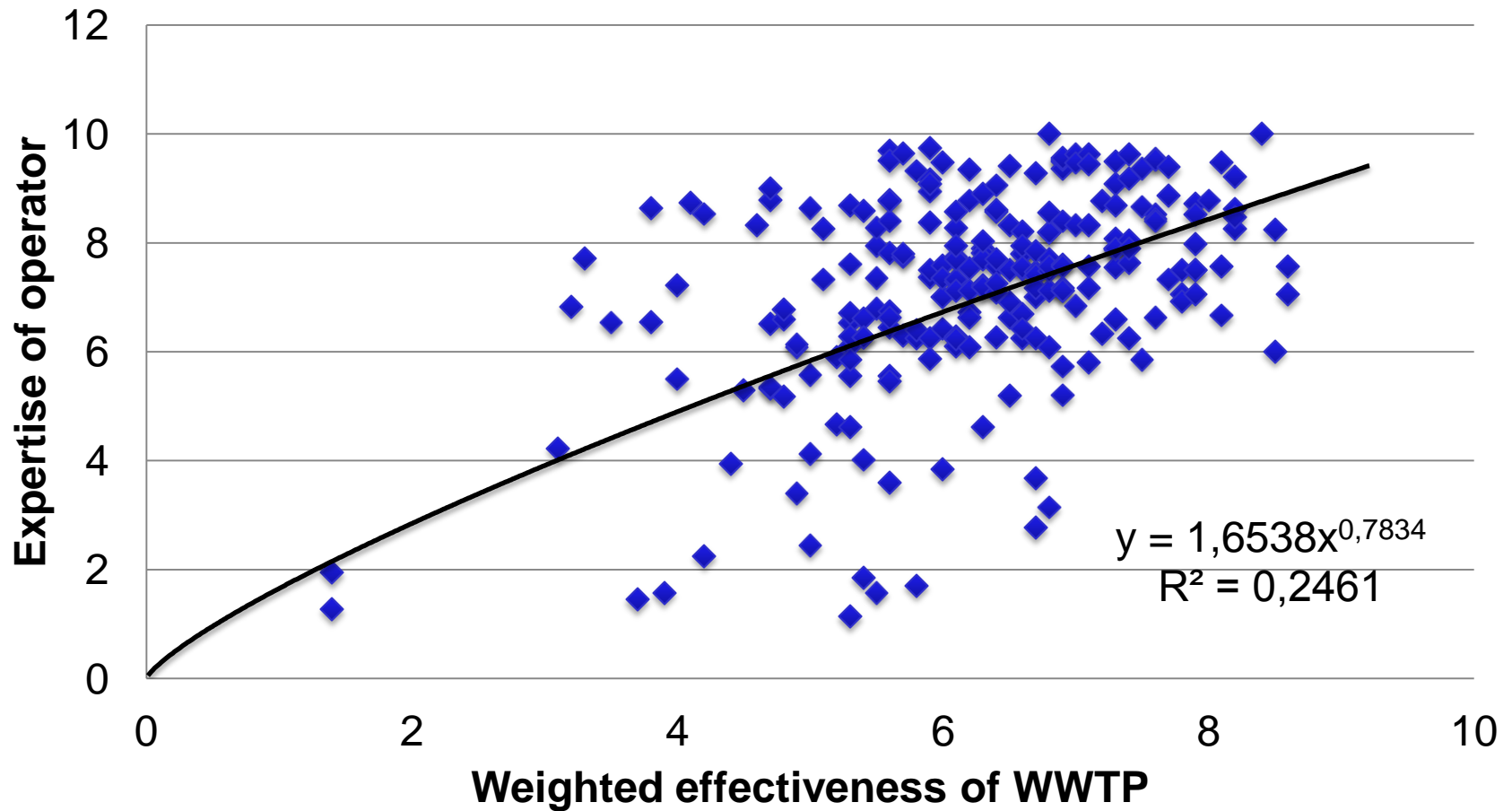
Chemical analyzes do not always confirm evaluation on site



Technical complexity does not limit effectiveness



Operator is important!



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Thank you!

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