Performance Indicators for Distribution System Risk Management

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Introduction

- Performance indicators - important tools in decision making

- Translate fuzzy or vaguely expressed states, values, objectives into formalized parameters to be used in decision making and work processes.

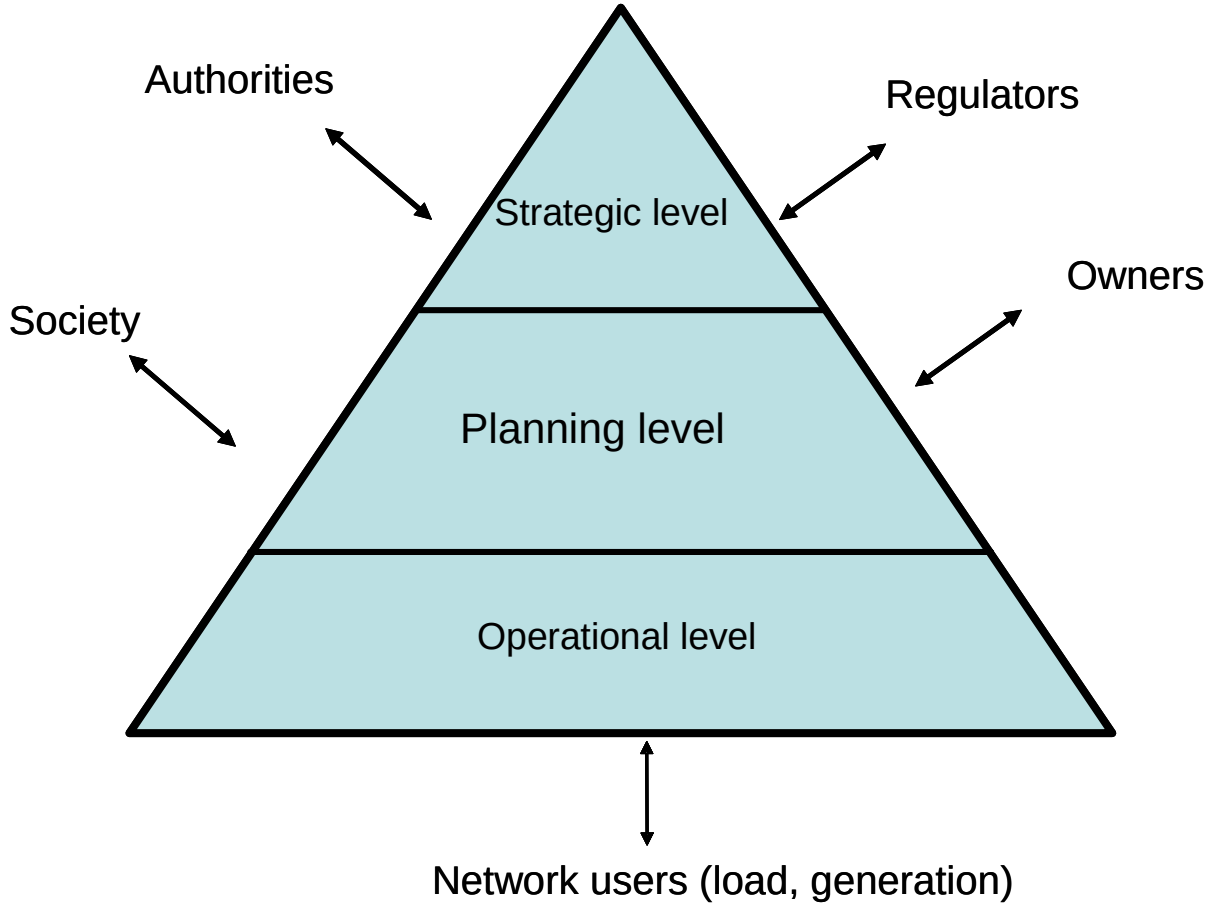
Distribution system risk management

- Risk analysis attempts to answer three fundamental questions:

1. What can go wrong?
2. How likely is it to happen?
3. What are the consequences?

To quantify risk calls for metrics or indicators

Distribution system risk management - decision levels



Some definitions:

- Indicator (performance indicator):
  - Parameter giving performance or state information (in an organization, department, process, plant, component…) which allows assessing the condition and can be used in decision and work processes.

- Key performance indicator (KPI):
  - An indicator mainly used at strategic levels, which is often aggregated from a set of underlying indicators.

Performance indicators in an objective function

Minimize distribution system risk :

$$\text{Min } R = f_1(p,x)+f_2(p,x)+f_3(p,x)+f_4(p,x)+f_5(p,x)+f_6(p,x)+f_7(p,x)$$

while satisfying the following relevant restrictions:

$$p \leq p_{max}$$

where:

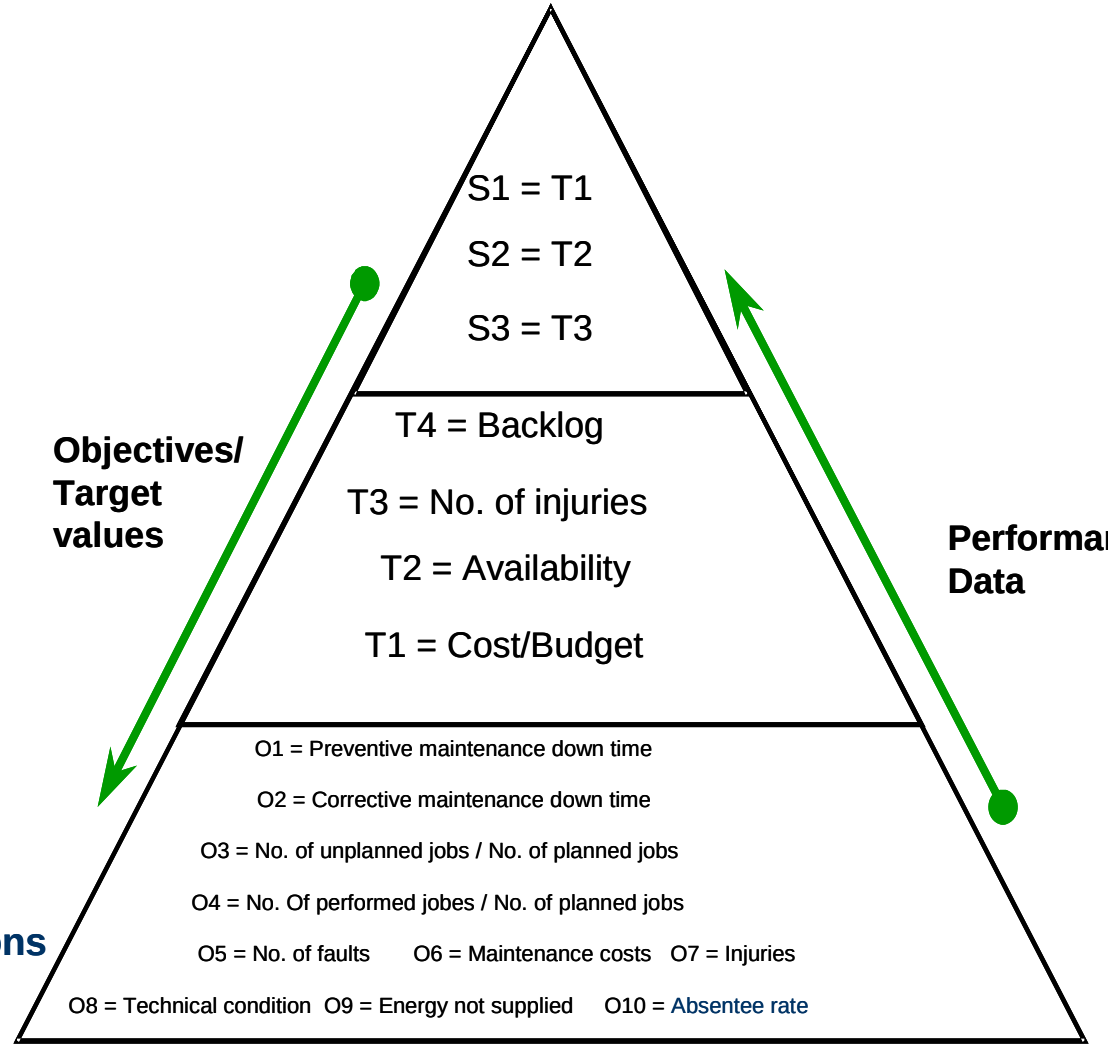
R	-	Total risk
$f_1(p,x)$	-	Economic impact function
$f_2(p,x)$	-	Quality of supply impact function
$f_3(p,x)$	-	Vulnerability impact function
$f_4(p,x)$	-	Safety impact function
$f_5(p,x)$	-	Environmental impact function
$f_6(p,x)$	-	Reputation impact function
$f_7(p,x)$	-	Contractual impact function
p	-	vector with parameters and **performance indicators** (p1, p2,…pm)
p_{max}	-	vector with constraints including acceptance criteria (p1max, p2max,…pmmax)
x	-	vector with decision variables (x1, x2,…xn)

Performance indicators - information flow

Strategic level
Overall strategies

Planning level
Tactical decisions

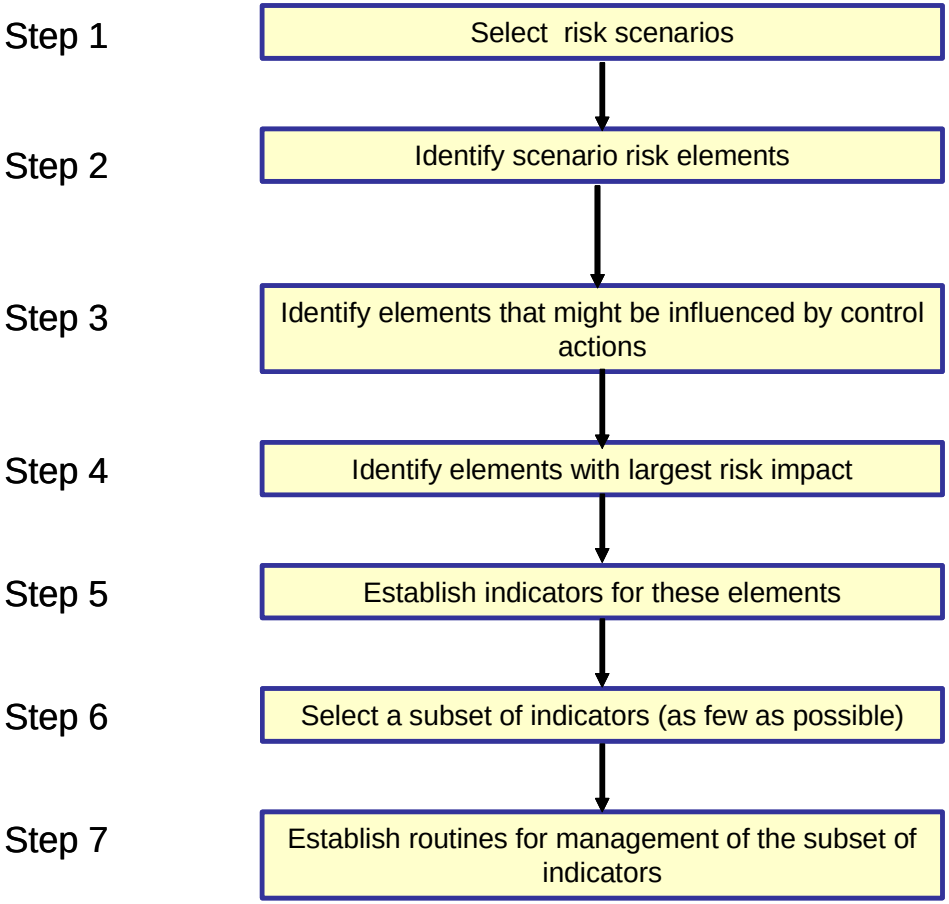
Operational level
Operational decisions



Objectives/ Target values

Performance Indicators Data

Development of risk indicators/ performance indicators



Indicator checklist

- Is the indicator unambiguous and well-defined?
- Is it linked to the company objectives and values?
- Are the resources required to record the indicator proportionate to the expected benefits?
- Is it easy to use in decision processes?
- Do the users find it relevant?
- Is it accepted?
- Can the indicator be influenced by present or future control actions (or is it only giving historic information)?

Example from an indicator survey

Performance indicator	**Risk relevance** (3= Large 2= Medium, 1=Small, Blank= No relevance)						
	Economy	Quality	Vulnerability	Safety	Environment	Reputation	Contracts
No of km 1. generation PEX cable (XLPE)	2	3	3			1	1
No. of regulatory deviations	1	1	2	3	1	1	1
Customer satisfaction index						3	3
Telephone response index						3	3
No. of customer complaints		2			1	3	3
Cost of Energy not supplied CENS	3	3	1			2	2
Sick leave rate	1					1	1
Overhead line versus cable length ratio		3				1	1

Concluding remarks

- Performance indicators are very important tools in decision making for asset management
- Relevance is important
- Performance indicators should record information at lower organization levels and they should be aggregated in a relevant way to provide a basis for decisions at higher decision levels.
- The survey showed that consciousness concerning performance indicators is not very mature within the DNOs, but is recognised as a logical consequence of implementing a more formalized risk management concept.