INFRALERT

Linear infrastructure efficiency improvement by automated learning and optimized predictive maintenance techniques

INFRALERT Deliverable D6.1 **Summary Sheet**

DELIVERABLE TITLE:

D6.1 Smart Decision Support Framework

WORK PACKAGE:

WP6. Smart operation and maintenance decision support

- **T6.1.** Definition of a concept for condition- and risk-based interventions planning
- **T6.2.** Design of a framework for smart operation and maintenance decision support

Deliverable Leader:
FHG

Contributing Partners:
CEM, USE, LTU, REG

EXECUTIVE SUMMARY:

The condition- and risk-based planning concept forms the "backbone" of the decision support tools. It defines guiding principles and features as well as provides a common structure to be followed when deploying and applying decision support systems to the process of maintenance planning. The concept has been defined in alignment with the specifications made for the Alert management (WP4) and the RAMS&LCC analysis (WP5). To this end, the following subtasks have been carried out:

At first, the background of INFRALERT's concept for maintenance planning has been reviewed, which are the maintenance policies and planning principles pre-existing in theory and practice. When defining the novel planning concept, references to these groundwork are made and basic assumptions and ideas are used and refined. It is common practice to distinguish several planning levels that decompose the overall maintenance planning process into single steps with dedicated tasks and decisions to be made: strategic, tactical and operational (or dynamic). We provide a brief definition of these planning levels and show their scope and the boundaries between them.

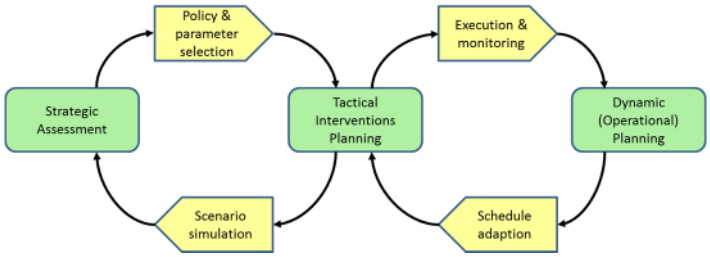
The concept for maintenance planning and the decision support framework as developed in this Deliverable are based on several so-called building blocks, each of them providing a dedicated functionality, processing specified input and delivering specified output. The framework basically defines the linking between these blocks to conduct the maintenance planning process. Besides the building blocks that are at the core of the planning concept - dealing with strategic, tactical or operational planning tasks - there are also important ambient blocks feeding the planning tasks with information, doing certain computations in the form of pre- or post-processing within the overall complex process. The most important amongst them - RAMS&LCC analysis, risk assessment, nowcasting and forecasting, alert management - have been summarised and the proper use of the information provided by these

ambient building blocks are described.

A mathematical methodology to use probabilistic data for decision-making in optimisation problems is at the core of the concept for condition- and risk-based planning. This methodology allows to deal with uncertainty in maintenance and interventions planning, which is a necessity that arises in practical applications. The document in detail describes the integration of probabilistic information about maintenance alerts, asset conditions, defects and their transition, maintenance interventions and respective costs and resources as well as RAMS parameters and how they will be modelled as stochastic variables for optimisation under uncertainty.

To deal with such a setting, a solution approach has been developed that makes it possible to have "a look into the future" and to estimate or determine the consequences of decisions to be expected in the future. In this way, decisions to be taken now and having an effect in the future can be balanced with regard to robustness of planning.

The developed planning concept follows a nested and adaptive approach: dynamic, tactical and strategic planning levels will get linked together, providing feedback to each other in terms of input and results, planning at each level is done in a rolling time horizon.



Finally, the smart decision support tools to be developed will be a part of the automated data processing chain of the INFRALERT eIMS. Since maintenance and intervention planning is the end point of this chain there is high demand for interactivity with the user of the system. To assure a high acceptance and usability of the planning tools, a framework has been designed to integrate smart decision support with existing procedures and building blocks. The resulting framework is general enough to be easily adapted and applied to a wide range of maintenance planning scenarios. It provides the basis for the development of specific optimisation models following the condition- and risk-based planning concept.

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