



Macro planning open discussion

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Finally an Innovation V Cycle to solve an extension of existing needs and solutions

Main stages of the V-cycle method

Politics and administrations : define the general needs and fix the quantified objectives of resilience

Politics and administrations check that new trains/infra/stations answer the new resilience objectives

Public main operators and infra managers :
* define the needs specs for RS/Infra/Station
* co-write norms/regulation/TSI

Public main operators and infra managers:
* receive and validate the new hardened solutions resilient to extreme weather events

Macro planification to be made on this V cycle basis (see the 10 steps process)



Industrials:

- co-write norms/regulation/TSI
- develop technologies and products
- Sell them on commercial projects at accepted prices (customers ROI)

How to plan these 10 steps

- Step1 : **Actual precise state of play** (European database connecting extreme weather-excessing nominal actual specifications- and railway RS-Infra-Stations incidents/accidents)
 - T0 : started
 - T final: **TBD, 2028?** (sufficient maturity level to consider the DB accurate and exhaustive enough)
- Step2 : **Predict the future characterized weather problems**, based on GIEC Scenario
 - T0 : started
 - T final: **TBD, 2028?** knowing the fact that uncertainties will remains
- Step3 : **Define technically what “resilience to climate change” means exactly** in railways
 - T0 : started (but only general definitions)
 - T final: **TBD, 2030?** as technical details are needed, probably a norm to define in each extreme weather event what resilience in meaning on RS, Infra and station

How to plan these 10 steps

- Step4 : Define quantified detailed **resilience objectives** (ideally at European level)
 - T0 : could start as soon as step3 is completed
 - Tf : **TBD** , **2030** ?
 - **Clarify approach vs political “precautionary principle” (= Politicians don't want any injuries or deaths on public transport = do not want to take any risks.)**
- Step5 : **Update norms** with new environmental conditions
 - T0 : debate started, but on limited scope (ex : max ambient temperature in Europe 50°C vs 45°C)
 - Tf : only when step2 will be considered mature enough without any additional possibilities to reduce the uncertainties, **2030** ?

How to plan these 10 steps

- Step6 : **Develop new technical solutions**, more resilient to extreme weather events
 - Who is going to pay? Industrials only ? Public funding to reduce financial risks on future markets?
 - T0 : started, but on limited scope (heat waves/RS HVAC impact; possibilities; limitations; re-debate on passenger thermal comfort)
 - Tf : **TBD** , 2040 ? In fact **depends on the objectives of step 4 and the money that stakeholders are ready to pay to keep high operational performances in extreme wheather events**
- Step7 : Size the budget costs to deploy all of these solutions at European level/countries/ Regions
 - T0 : **2035** ? step2 to 5 completed inputs needed and general studies of step 6 completed. Detailed figure will need step6 to be completed. =2040?
 - Tf : **2040**?

How to plan these 10 steps

- Step8 : **Find the investment budget (on serie products)** to update the railways infra and RS with the solutions developed in point 6
 - To : started, but on local specific problems only
 - Tf : **2040 ?**, depends on step3 to 6.
- Step9 : in parallel to step 8 : refined the budgets needs and **plan** work/developments **per priorities**
 - If a general approach is too complex/too costly, a local and limited approach could be envisaged
 - Ex : propose RS HVAC able to tackle heat waves in South Europe in 2030; propose flood resilient infra in frequently flooded european Regions in 2040, etc.
 - **ROI to be evaluated for each use case** (ex : HVAC/Heat Waves,etc.)
- Step10 : Organize the Call for tenders of Commercial projects and deliver
 - T0: **2030?** (depending on general approach of local/specific approach),
 - Tf : **2060?**



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