Title: Reliability Model based Cost computation Tool applied to 4R process

In rework and repair operations, early-stage estimation of risk assessment costs is hindered by uncertainty in the nature of the operations, variability in reliability targets, and the complexity of underlying failure mechanisms. At a point when budgeting for quality control is essential, the lack of foundational data often leads to inaccurate cost projections.

This paper introduces a configurable framework that integrates accelerated testing models with a project-planning tool to reduce cost uncertainty in repair and remanufacturing processes. Project managers can define the desired level of complexity and reliability based on customer requirements, and the tool then evaluates viable cost scenarios accordingly. By leveraging models such as Arrhenius, Coffin-Manson, and Hallberg-Peck—along with internal rules for activation energies and sample sizing—the system calculates the testing effort required to demonstrate a specified reliability objective.

The reliability target, chosen by the project manager, acts as a key input in the overall cost evaluation. The result is a structured cost range that accounts for different warranty levels and failure physics, enabling more informed decision-making early in the project lifecycle.

This methodology supports design-for-repair strategies by improving predictability in quality planning and enhancing transparency in cost-risk tradeoffs. It also aligns with circular economy goals by optimizing resource use and supporting more sustainable product life cycles.