

A value-centric approach to digital twins for rail and road infrastructure asset management

Summary

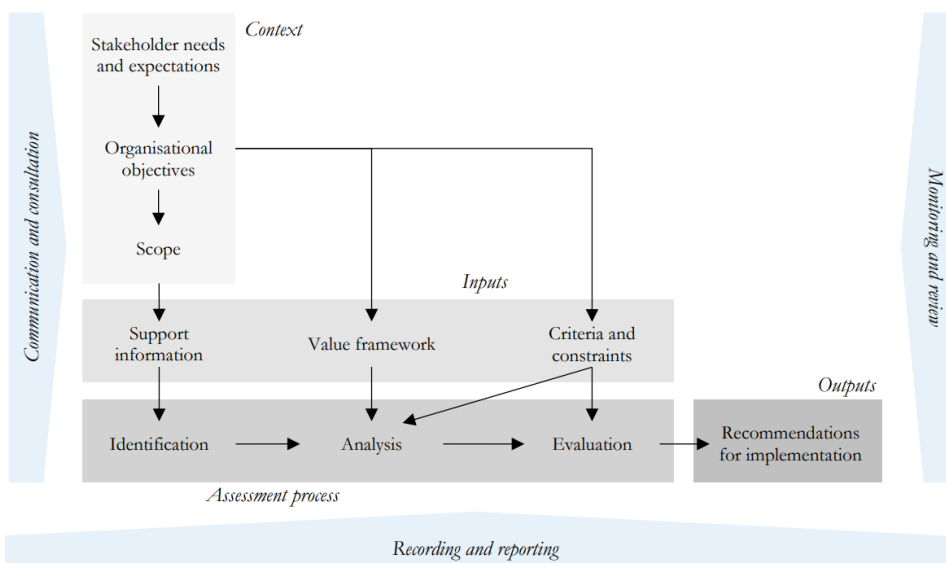
Rail and road infrastructure networks play a crucial role in modern societies. Considering the increasingly stringent requirements these networks are facing, rail and road infrastructure asset managers are pushed to allocate the available resources to the opportunities that deliver the most value to the organisations and their stakeholders. Simultaneously, infrastructure asset managers are being pressed to innovate and adopt the new opportunities brought by Industry 4.0, namely the Digital Twin (DT). However, the dissemination of DTs in the rail and road sector is still in the early stages. Confusion persists not only about their meaning but also regarding their value to infrastructure asset management. Moreover, traditional tools and value frameworks used by such organisations are not prepared for analysing investments of this nature.

This work’s main objective is to deliver an approach that allows rail and road infrastructure asset managers to understand what DTs are and what value they can bring to these organisations. The research approach consists of: i) performing a literature review to investigate the state-of-the-art on DTs in rail and road infrastructure asset management; ii) organising the concept into a harmonised framework; iii) understanding how DTs could help rail and road infrastructure asset management; iv) developing a value-based analysis of digital twinning opportunities to support investment prioritisation; v) proposing a value-centric management process that can support the digital twinning journey of infrastructure asset management organisations. The research outputs were developed and tested with real-world case studies within Infraestruturas de Portugal, S.A. – the largest transport infrastructure management organisation in Portugal.

By shifting the focus from DT as a product-based concept to digital twinning as an evolving process-based approach, this work helped asset managers to: i) overcome the obstacles brought by the conceptual dispersion in the literature; ii) understand and communicate impacts of different nature when dealing with different digital twinning opportunities; and iii) look at DTs with a more purpose- and value-centric approach, better aligned with the internationally recognised asset management practices. The conceptual framework brought by this work helps prepare the ground for the incoming need for an integrated approach to reporting and prioritising different competing investments in infrastructure asset management organisations, including those related to the digital twinning journey.

Keywords

Digital twin, digital twinning, value, asset management, rail and road infrastructure



Value-centric management process for digital twinning opportunities (VMP-DigiTO)



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Period

2019-2025

Funding

Infraestruturas de Portugal, S.A. Scholarship