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Impact Assessment of railway systems to increase attractiveness

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The research addresses the deployment of new systems that can enhance railway operational capacity and efficiency. The research introduces a framework to support the analysis and strategic development of railway systems. It applies interdisciplinary approaches to complex decision-making, including market potential assessment, decision-making, and scenario-based roadmapping. The analysis was showcased for Moving Block (MB) and Virtual Coupling (VC) railway signalling technologies and is developed further for application to other systems. The developed framework provides a coherent and holistic architecture within the development and evolution of systems where step-changes can be explored, mapped and interpreted based on distinct scenarios and specific project context. It can also foster business growth and organizational changes. The study evaluates the railway system's attractiveness across railway segments. The goal is to promote a shift from other transport modes to rail, ultimately leading to reduced road traffic congestion and CO2 emissions. Further, a Multi-Criteria Analysis (MCA) offers a comparison among alternatives across multiple criteria like cost, capacity, energy consumption, and regulatory approval. Findings reveal that the integration of SWOT, MCA, expert judgement, gap analysis and scenarios within the framework provides a means for addressing corporate challenges and exploring new application opportunities, even in low-developing countries. Finally, the study provides a detailed roadmap, showing how the implementation of railway systems can maintain efficient operation even under degraded conditions. This comprehensive study equips railway practitioners with strategic planning tools and implementation roadmaps for deploying new railway systems and advancing rail technology amidst growing railway demand.