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Systems Lens: Towards Sustainable Management of Maintenance and Renewal of Wire-Based Infrastructure: The Case of Water Network in the City of Linköping, Sweden

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Abstract : The city's wire-based infrastructure systems (WBIS) are responsible for the delivery of electricity, telecommunications, sanitation, drainage, and district heating and are a necessity for sustainable modern urban life. Maintaining the functionality of these structures involves high costs and, brings disturbance to the local community and effects on the environment. One key reason for this is that the cables and pipes are placed under streets, making system parts easily worn and their service lifetime reduced, and all maintenance and renewal rely on recurrent needs for excavation. In Sweden, a significant part of wire-based infrastructure is already outdated and will need to be replaced in the coming decades. The replacement of these systems will entail massive costs as well as important traffic disruption and environmental disturbance. However, this challenge may also open a unique opportunity to introduce new, more sustainable technologies and management practices. The transformation of WBIS management for long-term sustainability and meeting maintenance and renewal needs does not have a comprehensive approach. However, a systemic approach may inform WBIS management. This approach considers both technical and non-technical aspects, as well as time-related factors. Nevertheless, there is limited systemic knowledge of how different factors influence current management practices. The aim of this study is to address this knowledge gap and contribute to the understanding of what factors influence the current practice of WBIS management. A case study approach is used to identify current management practices, the underlying factors that influence them, and their implications for sustainability outcomes. The case study is based on both quantitative data on the local system and data from interviews and workshops with local practitioners and other stakeholders. Linköping was selected as a case since it provided good accessibility to the water administration and relevant data for analyzing water infrastructure management strategies. It is a sufficiently important city in Sweden to be able to identify challenges, which, to some extent, are common to all Swedish cities. By uncovering current practices and what is influencing Linköping, knowledge gaps and uncertainties related to sustainability consequences were highlighted. The findings show that goals, priorities, and policies controlling management are short-termed, and decisions on maintenance and renewal are often restricted to finding solutions to the most urgent issues. Sustainability transformation in the infrastructure area will not be possible through individual efforts without coordinated technical, organizational, business, and regulatory changes.

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