SYSTEMS THINKING APPROACH TO MODERNIZATION AND MAINTENANCE OF AGING INLAND WATERWAYS INFRASTRUCTURES

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ABSTRACT

This research explores a systems thinking approach for aging Inland Waterways Infrastructure with the intent to analyze the effectiveness of modernization and maintenance at the system level. Authors hypothesize that current practices to allocate resources for modernization and maintenance needs are not effective at increasing the utility of the system as a whole.

The systems thinking approach proposed in this paper develops a holistic examination of how components of the system are related to each other. The key to this approach is examining the interrelationships between modernization and maintenance impact factors; such as usage frequency, failure frequency, future demand, deterioration, condition interdependencies and effects of each factor on the system as whole. Previous researchers have analyzed each modernization and maintenance impact factor separately; however, interrelationships between these factors and the effects at the system level have not been explored. The approach presented in this paper provides a decision-making framework for optimal usage of resources for the aging inland waterways infrastructure, thus providing a long-term solution to modernization and maintenance issues and increasing the availability and reliability of the system.

Keywords: Optimization, decision making, resource allocation, asset management, budget prioritization

INTRODUCTION

For more than two centuries, the U.S. inland waterways infrastructure has been a vital national asset. This asset is utilized by many stakeholders; including nearby communities, transportation groups, power plants, and biologists. Although the inland waterways infrastructure is critical to our nation's economy and social well-being, the modernization and maintenance of these assets have not received the required attention. Lack of modernization and maintenance of the aging inland waterways infrastructure create a danger for losing this important asset ultimately causing disruptions on transportation services, flood management, water and power supplies, and wildlife.

Over the past decade, improved asset management techniques have been implemented; however, limited resources force authorities to practice linear-thinking approaches resulting in short term solutions. A systems thinking approach should be considered which will assume the system as a whole and examine how the components of the system are related to each other, thus offering a holistic explanation of the problem which will lead to a holistic solution. If a systems thinking approach is applied to modernization and maintenance activities, then the reliability and availability of the systems as a whole could be increased.

This paper describes factors that impact the modernization and maintenance of the system. By analyzing the interrelationships between these factors, the areas requiring attention can be demonstrated. The approach described in this paper can prioritize modernization and maintenance resource allocation decisions. This approach is useful especially considering the limited resources.

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