



Integrating lifecycle asset management in the public sector

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Abstract Lifecycle management of assets is essential for cost-effective maintenance and long-term economic viability. Properly maintained infrastructure provides significant economic advantages. Neglecting maintenance leads to lower productivity and imposes costs on users. Furthermore, delayed maintenance significantly increases total costs associated with repair or replacement. Lifecycle asset management should be used in the public sector to manage large-scale assets such as transportation infrastructure in a cost-effective manner. Yet, state governments have had little incentive to provide proactive maintenance. To address the infrastructure capital investment backlog, particularly acute in transportation, government priorities need to be coupled with long-term economic accountability. In addition, funding and financial reporting mechanisms should be created to ensure effective and efficient lifecycle asset management decisions. Public-private partnerships (PPP) also need to be fostered to help address regional deficiencies in infrastructure.

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1. Public sector infrastructure

Lifecycle management of infrastructure is essential for all public sector assets. Public sector infrastructure is broadly defined to include capital assets affecting water, sanitation, environmental protection, education, and transportation. Emphasis should be placed on ensuring that public capital assets are safeguarded and maintained to achieve

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their effective and efficient economic and social contribution. Underinvestment in transportation infrastructure maintenance illustrates the failure to provide lifecycle management and forgo the full value of these assets.

2. Transportation infrastructure

Ongoing investment and innovation raises national competitiveness and enhances living standards. The quality of existing transportation infrastructure is viewed as a critical foundation for productive investment. Governments around the world are demonstrating a renewed focus on fiscal stimulus via transportation infrastructure investments (PwC, 2017). Yet, transport systems can quickly lose value if not maintained. Maintenance expenditures provide for the repair and safe operation of existing roads, bridges, waterways, and transit systems. Neglecting maintenance leads to lower productivity.

In the short term, poorly maintained transportation infrastructure imposes costs (e.g., delays, damaged vehicles, greater packaging requirements) on users. Over the long term, deficient maintenance markedly increases the cost of disposal and reconstruction (Wessel & Olson, 2017). In addition, the environmental impact of deficient transportation infrastructure, although underresearched, is thought to be significant.

Lifecycle asset management has been used by the private sector to manage assets with long, useful lives, but government agencies have not readily adopted this approach. This has led to inadequate repair and maintenance of infrastructure, particularly transportation infrastructure, in the U.S. and in many other countries. According to a U.S. Department of Transportation (2015) report, U.S. roads and bridges faced a capital investment backlog of \$836 billion in 2015. Although there have been attempts to get government agencies to better manage the maintenance of infrastructure, these efforts have mostly failed. In this article, we describe several levers to impose asset management discipline on the diverse agencies managing our transportation infrastructure. Before we describe the levers, it is important to explain prior attempts to bring lifecycle asset management into the public sector and analyze why it has not been widely implemented.

3. Lifecycle asset management

Lifecycle asset management is defined as the combination of management, financial, economic, engineering, and other practices applied over the full

lifecycle of physical assets to provide the required level of service for present and future customers in the most cost-effective way (NAMS Group, 2006). Lifecycle asset management represents a systematic, holistic approach to asset development and preservation that ensures maximum service performance at minimum lifecycle costs (Federal Highway Administration, 2000; Lemer, 1999). Asset management encourages managers to consider trade-offs between deferred maintenance and preventive maintenance, between short-term fixes and long-term solutions, and between today's costs and tomorrow's benefits (Shewan & Kovacs, 1995).

The private sector has used lifecycle asset management to manage large-scale assets in a cost-effective way for operations such as electric power plants, oil-drilling platforms, and refineries, many of which are valued in the billions of dollars. Such large-scale assets and facilities are intended to last anywhere from 25 to 99 years. Maintaining a state of good repair throughout these assets' service lives depends on the quality of design and construction, the proactive nature of maintenance and renewal, and the timely rehabilitation of critical features. If properly implemented, asset management principles should influence all aspects of the lifecycle, including planning, design, construction, maintenance, rehabilitation, and disposal/recycling or replacement. This is demonstrated in Figure 1. Much of the credit for private sector interest and use of asset management principles can be attributed to the dire consequences of asset failure in terms of lost revenues and profits.

Several research studies support infrastructure investment as supporting productivity growth. A study by the International Monetary Fund (2014) found that infrastructure investments raise economic output in the short and long term. Transportation infrastructure has improved business efficiency and reliability (PwC, 2017). A strong transportation infrastructure also attracts foreign investment in productive activities. Regions have seen an increase in employment, particularly in labor-intensive, blue-collar positions from ongoing transportation infrastructure maintenance investment. Carbon emissions from delays and damaged vehicles are mitigated with well-maintained infrastructure. According to World Bank (1979, 2005, 2007) reports, the returns on transportation infrastructure maintenance investment were almost twice those of new construction projects. Strong levels of transportation infrastructure maintenance expenditures enhance a country's growth rate.

Political attention has been given begrudgingly to the concept of lifecycle asset management as it applies to large-scale, long-lasting public sector

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