Arthur D Little

Viewpoint

Efficiency & effectiveness in rail operations

The role of long-term capex planning and major asset renewal and replacement

In this Viewpoint, we examine the challenge faced by major rail operators in Asia as they seek to address the unavoidable reality of aging assets, while at the same time delivering major capital projects. We then highlight the role that effective long-term capex planning and execution can play in helping operators to overcome the "totex dilemma" and optimize the efficiency and effectiveness of rail operations.

Headlines reporting major rail infrastructure projects across Asia – including Hong Kong's Express Rail Link, the Kuala Lumpur-to-Singapore high-speed railway, and of course China's ambitious One Belt One Road (OBOR) strategy – do not struggle to capture the imagination, with promises of reduced journey times and new possibilities for commerce.

In parallel, digital technology presents new possibilities for how rail operators can maintain and assure their assets. Increasingly, leading operators are embracing predictive and condition-based monitoring techniques to increase asset availability, reduce costs and enhance safety.

Yet, beyond the prominence of major capital projects and digitally enabled maintenance regimes, there is another, less visible battle being waged by the world's foremost railway operators. To optimize the efficiency and effectiveness (E&E) of their operations, operators must address the harsh reality of aging asset bases. While this can be interpreted in different ways, in this paper we define E&E as **the optimal use of limited corporate resources by rail asset operators to address strategic business needs and deliver consistent, high-quality operating railways within cost parameters.**

Europe's rail networks are, of course, no strangers to asset renewal and replacement. In the UK, Transport for London (TfL) stands to spend £5.5bn on its 4 Lines Modernisation (4LM) program, where infrastructure dating back to 1863 will be replaced across four Underground lines.

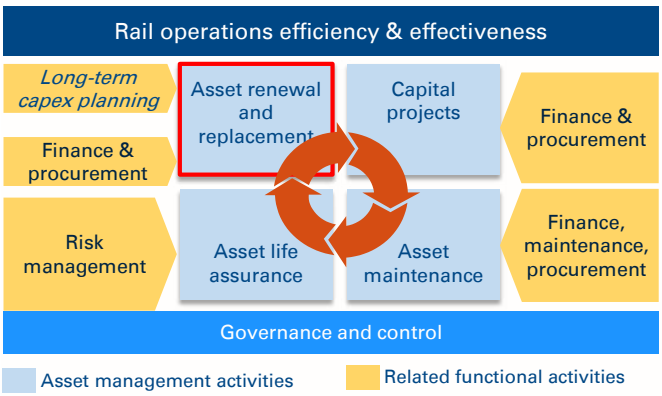
In Asia, however, such wholesale renewal and replacement of assets is a relatively recent phenomenon. As major metro-rail networks, such as Singapore's SMRT and Hong Kong's MTR, approach 30 and 40 years of service, respectively, decisions on asset renewal and replacement cannot be perennially postponed. Such operators must determine how best to organize themselves to deliver effective decision-making and oversight of major capex programs. This must be achieved while giving careful consideration to a number of factors, not least, customer expectations, railway ownership structures and, in some cases, a widening gap between revenues and the total cost of operating the railway (which comprises both opex and capex elements) – or "totex."

The link between E&E, long-term capex planning and asset replacement

Before examining the specific challenges related to asset renewal and replacement, it is important to set out at a high level the positioning of asset management as a discipline, and how it relates to associated functional activities. As shown below, capex replacement is one of four core activities within the asset-lifecycle framework.

This highlights that asset renewal and replacement are not siloed activities, but integral to other asset management and functional activities. Further, as we will show in this article, to optimize E&E, long-term capex planning must be treated as a functional activity in its own right, with the requisite resources and governance oversight.

Rail operations efficiency & effectiveness framework



Source: Arthur D. Little analysis

Drivers of asset renewal and replacement

In any asset-intensive industry, the time comes when there is a need to recalibrate the balance between operational performance, cost and the customer experience ("CEX"):

To consider some of the operational and financial drivers:

- **Asset life:** Whether defined as design life or useful operating life, the lives of assets such as escalators and lifts cannot be extended indefinitely. They must be subject to structured programs of renewal and replacement.
- **Capacity:** Faced with capacity pressures, some operators may replace existing rolling stock earlier than planned. Signaling systems may also need to be replaced for the same reason, to enable reduced headways and increase capacity.
- **Obsolescence:** In many cases, asset replacement is driven not by structural integrity or performance issues, but technical obsolescence. Signaling, ticketing and payment systems are particularly exposed, with operators forced to migrate to the latest technology systems once a software provider withdraws its support for the existing software.
- **External factors:** Finally, renewal or replacement can be driven by market developments, including changes in the price of new assets (e.g., the cost of new trains), leading to opportunistic procurement. Especially for publicly owned or regulated rail organizations, political pressure to replace aging assets and enhance the passenger experience can be an important influence.

While these operational and financial reasons for asset renewal and replacement are far from straightforward, the need to consider the customer experience dimension introduces additional complexity into the decision-making process. Governance arrangements must be sensitive to this third dimension.

Barriers to effective long-term capex planning

The inevitability of asset renewal and replacement, with their multiple root causes, creates an unavoidable need for rail-asset owners and operators to effectively plan their long-term capex needs.

However, the task of effectively forecasting and planning for long-term capex requirements is far from straightforward. While a short- to medium-term plan – for example, over a five-to-seven-year time horizon – can serve as a useful roadmap, plans inevitably become less meaningful the farther they project into the future. Even if a realistic planning horizon is in place, key stakeholders may not be incentivized to formulate accurate long-term forecasts. Such can be the pressures to "play" the system and secure access to funds that are needed to address immediate operational issues.

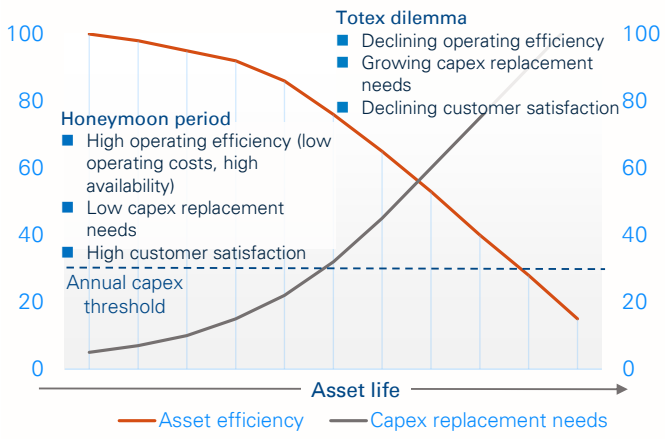
Failure to effectively reconcile divergent views on what genuine future capex needs actually are – especially between engineering, operations, finance and project managers – may further inhibit the attainment of a realistic view of long-term capex needs – and, crucially, needs that can actually be delivered.

While ownership structure can play an important role in shaping attitudes towards maintenance, renewal and replacement spend, shareholders, whether government or private entities, are unlikely to take kindly to sudden changes to long-term capex forecasts. This can place an additional brake on the development of more realistic plans.

"Totex dilemma": definition and response

Left unaddressed, the barriers to effective long-term capex planning can result in a particularly challenging situation for rail asset owners and operators, characterized by what we refer to as the "totex dilemma".

Dimensions of a world class operating asset



Source: Arthur D. Little analysis

This is a situation characterized by:

- **Aging asset base:** many core operating assets approaching or exceeding design life, in a similar period
- **Increasing operating costs,** as a result of running core operating assets beyond their intended design lives and incurring incremental maintenance costs
- **Backlog of capital works,** due to financial constraints, limited internal capability or capacity (e.g., possession of trackside), or "crowding out" by capital projects, even when these receive separate funding.

Additional issues in the form of flat or declining railway revenues, and long-established customer expectations of service standards, may heighted the challenge faced. Thus, a dilemma arises when an organization is faced with growing totex requirements and insufficient resources with which to meet these needs. While a long-term capex plan may exist, it may well have ceased to represent a meaningful plan – such is the disconnect between need, resources and ability to deliver.

Critical success factors

However, as illustrated, a railway's ability to effectively plan for and execute on its long-term capex needs is critical to its overall E&E. In line with this, we propose a set of critical success factors to overcome the "totex dilemma" and lay foundations for efficient and effective rail operations:

- **Requirements capture:** The divergent views of engineers, operators and project managers can result in a fragmented and inflated view of what an asset's required specification actually is, inflating costs. Remedies range from formalizing requirements-capture to lighter-touch coaching and shadowing. Nonetheless, especially in operational areas with direct customer interfaces, such as ticketing, the failure to formally reconcile competing internal perspectives with the "voice of the customer" can sow seeds for sub-optimal CEX, performance and cost outcomes in later years.
- **Governance and control:** Complementing a more robust approach to requirements capture is the need for effective governance, control and prioritization of capex-funding requests. Clearly, it is important to retain an element of flexibility to cater for truly urgent short-term needs. However, taken too far, this can create a culture of habitual capex deferral. The result is a growing capex, as organizational capability and resources cannot be expanded at the same rate. By contrast, a universally understood and enforced capital expenditure hierarchy that clearly differentiates between types of capex (e.g., renewal, replacement, commercial), and supports an effective interface to the finance function,
  is essential.
- **Incentives:** Changes to governance and control will only be effective if they are underpinned by the right incentives. These must address the unintended consequences of prevailing business rules and financial/operational targets. Participants must be encouraged to eschew political self-interests and engage in the process of forecasting capex needs and securing funding in a way that best reflects the long-term needs of the railway and its customers.
- **Enablers:** Effective capex planning is not an isolated activity, but rather has interfaces and dependencies that are critical to many functions, not least **maintenance, procurement and technology**. Efforts to shape more realistic long-term capex plans are unlikely to yield target benefits unless there are effective procurement and maintenance regimes in place. Capex plans must also be reflected in the technology strategy and vision, which should provide clarity on which Industry 4.0 technologies to invest in, and which not to.

Organizing for success

By addressing the aforementioned critical success factors, rail operators can take big steps towards the delivery of optimized capex renewal and replacement functions that enable greater efficiency and effectiveness.

However, this is far from the end of the line. In reality, decisions on asset renewal and replacement do not occur in a vacuum, but instead battle for organizational attention and resources with other priorities. These include major capital projects (e.g., new lines), continuous 'lean' improvement programs and immediate safety-related prerogatives.

As a result, an organization's processes and governance must be able to handle a complex mix of needs and decision types. In this context, there some key points that rail organizations must consider when assessing their ability to effectively and efficiently execute on their long-term asset renewal and replacement plans. These include:

1. **Independence:** Are investment decisions made on a truly independent basis, without the undue influence of one or more functional or stakeholder groups?
2. **Consistency:** Are investment decisions underpinned by a common set of criteria and clear understanding of risk-investment trade-offs?

Organizing for success

Source: Arthur D. Little analysis

3. **Accountability:** Are governance bodies and individual decision-makers endowed with clear objectives and accountabilities?
4. **Targets:** Do parameters (e.g., financial constraints) facilitate the effective capture and execution of asset renewal and replacement needs, or is there a risk of unintended consequences and false incentives?
5. **Quality:** Are adequate checks, balances and incentives in place to control the quality of key inputs into the budgetary and financial-planning processes (e.g., brownfield unit rates) and instill confidence in the resulting outputs?
6. **Capability:** Does the expression of need upon which investment choices are based reflect the organization's combined capability and expertise, or only that of a small set of asset owners/operators?

Conclusion

Faced with the triple challenge of operational performance, total cost management and the customer experience, rail organizations confronted by major asset renewal and replacement needs can find the path towards improved operational efficiency and effectiveness daunting.

The sheer pace and dynamism of technological change exacerbates the issue, by both challenging the longevity of existing assets, and by forcing operators to rethink deeply entrenched corporate mindsets founded on long-term planning horizons that may span several decades.

For organizations not quite sure how to proceed, non-action can become an inevitable consequence; however, the longer this persists, the worse the "totex dilemma" is likely to become. Equally, a piecemeal approach to asset replacement that fails to recognize the strategic importance of fully coordinated, long-term capex planning to the overall effectiveness and efficiency of rail operations is unlikely to deliver holistic benefits for cost and the customer.

By contrast, for progressively minded rail organizations that adopt some of the principles outlined in this article and succeed in mobilizing resources around such a vision, long-term asset replacement can be transformed from a curse into an opportunity – and present a pathway towards greater operational efficiency and effectiveness.

The most successful operators will be those that succeed in generating buy-in to realistic long-term capex forecasts and prioritized sets of requirements, which are supported by aligned business processes, governance arrangements, and incentives. Only then can operators escape the "totex dilemma" and transform asset replacement into a stepping stone towards sustainable improvements in operational efficiency and effectiveness.

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