HOW TO ACHIEVE A SUSTAINABLE INCREASE IN TRANSPORT INFRASTRUCTURE INVESTMENT

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ABSTRACT

This paper reviews the conditions for achieving a sustainable increase in transport infrastructure investment in South Africa. It covers four themes: the long term relationship between transport infrastructure investment and GDP growth; changing trends in the procurement of transport infrastructure; the implications of cost benefit appraisal for investment priorities; and whether ownership / institutional form affects sustainability of infrastructure spend.

In the case of the relationship between transport infrastructure and economic growth, investment in paved road infrastructure is shown to have a stronger impact on GDP than either rail or ports investment.

On procurement approaches, the key to sustainable infrastructure is to tailor the form of contract to circumstances, in terms of the timescale over which the benefits accrue and who the beneficiaries are.

Transport infrastructure investment cannot be increased sustainably if investment decisions ignore cost benefit appraisal results. Developments in monetarisation of environmental externalities and urban efficiency gains can help target infrastructure investments at locations and at the times when benefits will be greatest.

A review of UK rail privatisation and the corporatisation of Singapore Port show that effective regulation of public sector institutions can achieve sustainably increased infrastructure investment, without privatisation, if such institutions have economically coherent mandates.

1. INTRODUCTION

Research undertaken by Arup for the national Department of Transport (DOT) between April and August 2008 sought to understand the relationship between transport infrastructure investment and national economic growth in a way that might offer guidelines to Government regarding an optimal, or at least a sustainable, level of investment in infrastructure. DOT was interested in understanding whether periods of unusually high – or low – expenditure on infrastructure were associated with trends in GDP growth. The periods before, during and after South Africa’s 1994 political transition was of particular interest. Arup noted that South Africa was not the only country where this issue was being considered. The experience of the United Kingdom (UK) and of the United States of America (USA) was reviewed as context to inform research that would be undertaken regarding the South African situation.
In the UK, for example, a period of opposition to transport infrastructure expansion in the early 1990s was followed by huge growth in demand for transport following the subsequent long period of economic growth from 1993 to 2005. This eventually led to the realisation that a major expansion in transport infrastructure might yet be required, leading to the procurement by Government of the most comprehensive transport review it had ever undertaken, culminating in the Eddington Transport Study (December 2006). Eddington reviewed the role of transport in the British economy from the very beginnings of modern transport technology in the railways age, through to the present, seeking to understand what the case, is over the long term, for investing in transport infrastructure. The report was also innovative in that it sought to widen the scope of quantitative cost/benefit appraisal by developing techniques to place monetary values on factors such as improved efficiency of urban economies, and a wide range of environmental impacts, all in order to better understand the circumstances in which infrastructure investment makes most sense.

At more or less the same time, in the USA, it was beginning to be realised that simply managing existing transport assets more efficiently could not be the whole solution. Transportation for Tomorrow (2007) mapped out a strategy for responding to the massive growth in transport demand. Interestingly, the commissioners responsible were divided in their response to the situation faced by the USA: although most adopted a more proactive role for the public sector, a minority argued for a similar approach to that of the British to transport, with investment being more directly informed by economic appraisal and with greater private sector involvement.

South Africa has also experienced unprecedented sustained economic growth in the past 12 years. In the first 10 years after 1994 the priorities were, understandably, social infrastructure investment in the health, housing and education sectors.

The country was unused to being part of global trends and is now waking up rapidly to the huge implications for telecommunications, electricity generation and transport demand. Just as harsh lessons are being learned in the country’s electricity sector, the South African Government has realised that continued economic growth could be severely constrained if plans are not made for long-term transport infrastructure development. However, it wanted to ensure that this takes place rationally and sustainably. In a nutshell, it wanted to know “what is needed to bring about a sustainable increase in spending on transport infrastructure”. Arup in Johannesburg was awarded the study in March 2008 and it was completed in August of the same year. The study was partly desk research and partly undertaken through two one-day workshops, one for roads and one for rail and ports.

The research for DOT contained four main sections: statistics; the history of procurement; cost/benefit aspects; and whether institutional form matters.
2. TRANSPORT AND ECONOMIC DEVELOPMENT: THE STATISTICS

For at least 40 years economists the world over have studied the role of infrastructure in economic development. The broad consensus from all research is that transport infrastructure facilitates but does not create economic growth or development. But what of the long term? Do impacts vary over time or with different types of transport infrastructure?

Arup drew on some extraordinary statistical work done at the University of the Witwatersrand by Dr Peter Perkins (2003, 2005, 2006), now a senior statistician with Statistics SA. He prepared very long-term time series data sets of investment in transport, power generation and telecommunications infrastructure in South Africa, sourced from early British colonial government official reports, the South African Reserve Bank, Statistics SA, Spoornet, the CSIR, etc., as well as international sources. South African rail data went back to the beginnings of the industry in 1875, ports almost to the turn of the 20th century, and paved roads to the 1920s. These were all placed alongside data for GDP growth. All the values were, of course, based to a common reference year for comparability.

Perkins then conducted statistical tests and found that over the very long term, infrastructure investment does lead, or force, GDP development, thus corroborating the findings of more theoretical work. Comparison of the differing impacts of various transport modes, however, offers more interesting and perhaps controversial insights (see Figures 1–2 which illustrate the statistical trends that Perkins' work demonstrates to exist between rail capacity and paved roads investment, respectively and GDP growth).

Figure 1  Investment in rail capacity compared to GDP, 1910-2000
Paved roads investment 'supporting' GDP growth

Figure 2 Investment in paved roads compared to GDP, 1930s - 2000

It appears that rail freight transport growth is occasioned by periods of strong economic development rather than being itself the cause of general economic development. Investment is undertaken largely to capture specific trades rather than to seek to generate business speculatively. One policy implication from this is that major investments in new rail network capacity, at least in the case of freight transport, should be considered only if they are linked to a secured high-volume trade, where the economic benefits derive primarily from that trade and not from any wider economic impacts. This is not to deny the initial developmental impact of rail investment during the period up to the 1920s when it clearly had a major impact in realising economic potential in the mining and agricultural sectors.

In contrast to rail investment, statistics show the development of paved roads in South Africa to exhibit a long-term “forcing effect” on GDP growth; the evidence across the whole period measured being that investment in paved roads is supportive of general growth in GDP. In more recent years of high growth, road demand has absorbed previously developed capacity, with congestion being the inevitable outcome. The worsening freeway congestion indicates that it would be difficult to sustain long-term GDP growth without the further expansion of road transport infrastructure currently taking place.

And the evidence suggests that at a national level, and especially in connection with freight transport, paved road investment may be a more economic solution in addressing congestion than investment in rail capacity. Notwithstanding this, Section 4 below refers to evidence that offers a caveat to this conclusion on road investment, in the case of passenger transport by rail in dense urban areas.
It should be noted further that during the period from rail transport introduction in 1875 through to about the late 1920s, rail will have played a similar economic transformative role to that which the newer transport technology does now. From the perspective of what is today referred to as the science of supply chain, or logistics, the reason for the stronger economic impact of road investment than rail since then, is the distributional flexibility offered by the newer technology. This in turn has permitted many more geographical areas with economic potential previously untapped because not generating sufficient volume to make rail technology viable, to become economically active.

Clearly, statistics do indeed matter. Perkins himself nevertheless cautions against relying solely on these statistical time series based conclusions in making policy, and advises that investment decisions on which infrastructure to invest in should be supplemented by appropriate cost/benefit analyses. But, before examining that subject in section 4 of this paper, a review of how transport infrastructure has been procured historically follows. The purpose is to gain an understanding of how different procurement approaches have been used over time and how these approaches have sought to capture the value, whether to private or public interests, that infrastructure investment is thought to bring to an economy.

3. THE HISTORY OF INFRASTRUCTURE PROCUREMENT APPROACHES

The research undertaken for the DOT investigated trends in the ways that transport infrastructure has been procured over time and in different countries to see whether any general guidelines could be discerned that could inform the development of a more sustainable approach to transport infrastructure procurement in South Africa.

At the global level, cycles of private, then public, then back to private sector procurement can be discerned in both road and rail infrastructure development. The research tracked these cycles and found that an underlying explanation may lie in changing perceptions of who benefits from infrastructure investment, the scale of the benefits, and the timescales over which benefits manifest themselves. The answers to these questions typically explain who should pay and how.

Almost all rail industries around the world started with private investment. Most moved on to public ownership and investment responsibility, although the past 20 years or so have seen greater emphasis on private investment again. In the roads sector, the cycle appears to have been the reverse. In South Africa, these cyclic trends are not so clearly discernible, partly because in the long apartheid era the economy became increasingly isolated from international involvement.

Rail indeed commenced in the private sector in South Africa, with companies developing short freight and commuter lines in Durban and Cape Town from 1875 onwards. Inland, in the independent Transvaal Republic, the Zuid-Afrikaansche Spoorweg-Maatschappij (ZASM) privately developed a line from Pretoria and Johannesburg to the Mozambique port of Delagoa Bay (Maputo). Following Britain’s 1902 military victory in the Anglo-Boer War, these three railways first fell under military jurisdiction and then were amalgamated into the single South African Railways and Harbours Company in an Act of that name in 1913.
Although owned ultimately by government, the SAR&H was a commercial entity, not a government department. It was mandated to be commercially viable but also to invest in an expanded network to open up the country for mining and agricultural development. The network thus expanded to more or less its current extent by the end of the 1920s, the only significant additions since being the Richards Bay coal line and the Sishen-Saldanha ore line in the 1970s and 1980s.

From the 1920s and 1930s onwards, road and air transport respectively began to emerge as competitors to rail, although the rail sector, increasingly protected by government, continued to grow its business right through until the 1980s when partial transport deregulation legislation was introduced.

One consequence of this history is that, despite the dramatic loss of business to the roads sector, rail’s institutional heritage of being a custodian of national economic interest persists. This is a major factor preventing the SAR&H’s successor company, Transnet, from embracing some of the private sector involvement options by which railways in other countries have sought to recover a sustainable future for their stakeholders.

Roads procurement in South Africa has gone through a similar cycle to that experienced elsewhere. In the 1930s, national and provincial Roads Boards were constituted with responsibility for funding and procuring the construction of a rapidly expanding roads network. At the time of the transition to democracy in the early 1990s, experiments were under way with private concessions to procure major road developments such as the Maputo Corridor concession. The National Roads Board led this initiative, operating increasingly commercially in its final years before the transition.

These experiences foreshadowed the establishment of a new agency structure at national level, one aim of which was to transfer the burden of national roads funding and maintenance from the public to the private sector. In the decade since its establishment, the South African National Roads Agency Ltd (SANRAL) has been able to move away progressively from grant funding by central government to self-funding via concessioned and direct toll projects. The current Gauteng Freeway Improvement Project is the latest stage in this evolution.

SANRAL’s good experience with a more commercial approach to roads procurement indicates that, in the right circumstances, private sector involvement in infrastructure procurement should be followed more extensively. The national Department of Transport (DOT) explicitly asked Arup to assess the pros and cons of private sector participation models as part of a more sustainable transport infrastructure funding programme.

In summary, the history of procurement approaches teaches us that unsustainable approaches tend to occur when there is a misalignment between costs incurred and benefits produced. There can be misalignment of scale, when too much is spent for too little gain. This usually occurs after a new transport technology emerges and the previous one cannot offer the same benefits, which is substantially the reason why huge institutional realignment of the rail sector has been needed over the past 20–30 years.
On the other hand, too little may be spent when the potential economic gains are far greater than the financial costs incurred. In South Africa this seems to be the case with the roads programme, where the procurement model only partially captures the scale of benefits estimated by cost benefit appraisal.

This point has been emphasised in work undertaken at the University of Stellenbosch by Calitz and Fourie (2007). In an article entitled ‘Infrastructure in South Africa: Who is to finance and who is to pay?’ They draw attention to the fact that most infrastructure in South Africa is funded out of current revenues, despite its benefits accruing over more than one generation. They suggest that, subject to normal public finance probity principles, there is a case for greater state borrowing to fund infrastructure.

In conclusion, the key to sustainable transport infrastructure procurement would appear to lie in designing a model that can capture the maximum proportion of benefits at the minimum possible cost. The answer probably lies in some combination of using PPP as a procurement tool but applying this to projects that demonstrably yield national economic value. Moreover, where procurement efficiency and national economic value coincide, there is also a sustainable case for increased borrowing to fund infrastructure.

4. COST BENEFIT ANALYSIS AND INFRASTRUCTURE INVESTMENT

In the South African context, one main reason for lack of sustainability in infrastructure development is that projects with poor economic prospects are often pursued for perceived social gain, while projects with potentially greater economic benefits are set aside because of perceived disbenefits to targeted groups. Explanations for this include poor appraisal methods, institutional mandates that allow government agencies to judge investment priorities by non-economic criteria, or simply unwillingness to accept appraisal results if they do not appear to support prevailing policy objectives.

Although decisions may ultimately have to be made on the basis of democratic mandates, decision-makers need to be aware of the benefits and costs of their actions. When this is not so, institutionally mandated decisions may be presented publicly as economically beneficial ones, leading to ongoing distortions in infrastructure investment priorities to the detriment of society as a whole.

In the UK, the conundrum of strong public support for railways, but evidence that the social benefits fell far short of the costs, led the UK Government eventually to the most thorough re-examination of the case for transport infrastructure investment ever undertaken in Britain, namely the Eddington Transport Study (Eddington, 2006).

Eddington used the then current South and West Yorkshire Multi Modal Study to examine whether transport improvements add more value than just savings in travel time and costs for network users. He found that agglomeration, or urban efficiency gains could be measured and these can add a further 30-50% to conventionally calculated benefits. His next contribution to cost/benefit appraisal methodology concerned environmental impacts: he arrived at rationally defendable monetary values for a range of impacts, including global CO2 emissions, local air pollution, noise pollution and others.
Eddington then developed four appraisal stages, starting with conventional costs and benefits only, and working up to the inclusion of agglomeration and finally environmental impacts. These were applied to a package of urban and interurban transport projects (both road and rail). The overall conclusions were that benefits remain high for many of these projects, even after the social and environmental costs and benefits have been fully accounted for. Eddington noted further that by excluding expensive rail projects from the appraisal, benefits were yet higher.

The findings broadly confirmed previous evidence that most road-based projects typically yield higher benefit / cost ratios than most rail projects. The key to effective rail projects appears to be to align them as closely as possible with urban growth so that the agglomeration benefits rather than the conventional travel time and cost benefits are the key to project viability.

The implications of these findings are highly significant for projects in the UK and South Africa. London’s east/west Crossrail and the Gautrain Johannesburg/Pretoria rapid rail link have both faced sceptical responses from the respective treasuries because their conventionally calculated economic cost/benefit ratios are low – between 2:1 and 3:1 – even allowing for social and employment creation benefits. Recognition that the Gautrain might accelerate the already existing trends towards urban concentration and further CBD growth will be a key factor in its becoming a national economic asset.

In the main Eddington report (2006) this finding was couched with typically British conciseness: “The benefits of transport infrastructure investments will tend to be higher where they occur in support of strongly growing urban centres and on links between points of access to an economy and those urban areas.”

Arup recommended that transparent cost/benefit analysis methods be introduced to all transport sectors. This recommendation applied especially to Transnet, the State-owned rail freight and ports utility. At present Transnet is mandated to have a financially sound bottom line, which it has been able to achieve given its sole operator status in both sectors. But its mandate does not require it to apply broad based economic cost/benefit criteria to its major investments, to establish whether or not they are adding to national economic welfare. Given that South Africa’s overall economic strategy is to achieve “accelerated and shared economic growth”, this is an omission that really does matter and needs to be remedied urgently.

The emerging role of the national Ports Regulator and the DOT’s intention to introduce a rail economic regulatory function may, over time, put pressure on Transnet to motivate their major infrastructure investments more explicitly in national economic value terms and not just in terms of the commercial sustainability of borrowing, which in turn is only sustainable because of recourse to revenues arising from its ports and pipeline businesses.
In the final area of investigation, the question was whether public or private ownership matters as far as effective infrastructure construction and operation are concerned. To answer this, Arup sought assistance from colleagues in London and Singapore. The former contributed a discussion on how highway development and maintenance is managed in the UK, plus an overview of the UK’s rail privatisation experience, while from Singapore research assistance was provided in the form of a case study of the corporatisation of Singapore Port.

The main lesson from the UK was that the key to sustainable investment programmes is flexibility in contract form. The question of public or private ownership or management appeared to be less important than seeking the most appropriate institutional mechanism for the job in hand. This entails, among other things, ensuring that implementing agencies have effective managerial as well as technical engineering skills.

The UK’s rail privatisation experience has become a paradigm for industry practitioners in other countries to either loathe or love and the review undertaken by Arup revealed both positive and negative lessons.

On the positive side it is evident that, for passenger operations, privatisation brought significant benefits to consumers. The competitive franchising model resulted in a multiplicity of operators competing not on the same tracks but within a clearly defined regulatory framework of targets and penalties. The system has been robust enough to survive several franchisee failures. Government capital investment in the UK rail network has increased even as privatisation proceeded (Figure 3) and passenger numbers are at their highest level in history.

![Figure 3 Government capital investment in the UK rail network](image-url)
On the negative side, privatisation of the infrastructure effectively failed due to inadequate knowledge of the condition of the physical asset and hence massive underestimation of the maintenance and renewal costs. The original privatised operator, Railtrack, focused more on share price management than on the technical aspects of the business, so that initially the share price rose as passenger numbers increased. Although from a private business standpoint this may was a rational approach to achieving a sound credit rating for future investment funding, the public saw neglect of a public asset for short-term private gain. The Hatfield crash of 17 October 2000, in which four people died and dozens were injured, jolted Railtrack into awareness of its misjudgement of how extensive was the task of maintaining its infrastructure to modern safety standards. Government took Railtrack into administration and, against the economic evidence, recapitalised it and set it on its way again as the new, not-for-profit (but still notionally private) company, Network Rail.

Perhaps the most important lesson learned was that if a government regards as socially desirable a service that cannot be funded fully by the private sector, then it must take very seriously any decision to fund such a service. Taking this responsibility a step further, a government wanting a passenger rail service must ensure that mechanisms are in place to ensure good technical management of the network, as well as effective business management. And in the UK, it was evident that running a national rail network cost more than could be justified in any commercial business framework. A clear lesson from the UK's privatisation experiment is that without publicly subsidised infrastructure, the rail operators could not sustain their side of the bargain.

Key lessons for the sustainability of transport infrastructure investment in South Africa are that every possible effort must be made to understand the true costs of running a rail network. Given the country’s limitations on capital funding, it would be advisable also to identify the most cost-effective elements of the network in terms of selected service criteria, and concentrate available investment on these routes. This is what Arup advised in South Africa's recent National Passenger Railplan. All routes were ranked in terms of a range of service criteria, leading to a set of priority rail corridors where improvement efforts will now be concentrated.

The case study of Singapore Port was requested specifically by DOT to discern lessons for South Africa’s ports sector. On the surface, the structures of the ports sectors in South Africa and Singapore are very similar. An infrastructure-owning agency also acts as a sort of in-house regulator, and a service provider runs the ports themselves. There the similarity ends, however, because Singapore Port is one of the most efficient in the world, whereas in South Africa’s ports productivity is relatively low, given the technical sophistication of the equipment available, tariffs are regarded by the shipping industry as far too high.

The key lesson for South Africa is that protection inevitably reduces efficiency. Singapore was willing to allow real commercial freedom to the Port of Singapore Authority in a manner that forced it to face up to and respond creatively to the demands of the international shipping industry. For this to happen in South Africa, Transnet’s port operating business would need to be allowed the discretion – and the accountability - to freely choose how, and with whom, it will partner in optimising capital investment and operational performance in the ports sector.
6. CONCLUSIONS

Four main conclusions emerged from the DOT research on how to achieve a sustainable increase in transport infrastructure investment:

- Over the long term, investment in paved road infrastructure has proved to be more positively correlated with economic growth in South Africa than either rail or ports investment. Continued investment in rail capacity in South Africa will only yield significant economic value when focused on long distance haulage of bulk commodities or on urban rail projects where strong urbanisation and urban economic growth trends are present.

- Private sector participation can bring efficiency of procurement and cost control to transport infrastructure investments, but does not in itself guarantee national economic welfare. This will only occur if investments are focused on projects that are sound in national benefit cost ratio terms.

- For any transport infrastructure, a sustainable increase in transport infrastructure spending will require all investment decisions to be informed by broad-based cost/benefit analysis. Where strongly positive benefit to cost ratios can be demonstrated, there can be a strong case for borrowing additional funds to supplement current expenditure based spending.

- Private ownership of infrastructure assets is not an absolute prerequisite for a sustainable increase in transport infrastructure investment to occur, but if this goal is to be achieved in the public sector, then public agencies need to be mandated, under clear regulatory supervision, to align capital expenditure decisions with demonstrated national economic value.

REFERENCES


