Financing Of Large and Complex Civil Infrastructures Projects

K. Gharehbagh and V. Raso

Every country is facing an enormous challenge in meeting the requirements of the growing population and the infrastructure required to support communities. The challenge of financing and management of infrastructure projects is costly in terms of both capital investment and maintenance, yet quality infrastructure is vital to lift the productivity of any city. Large complex civil infrastructure projects face many financial issues which are often not managed to capacity nor are they used to their fullest capacity and this leads to inefficient and ageing infrastructures. Commonly there are two core types of infrastructure, “Hard” infrastructure which refers to, the large physical networks necessary for the functioning of a modern industrial nation. Then there is “Soft” infrastructure which refers to all of the institutions which are required to maintain economic, health, cultural and social standards of a nation.

Over the past 100 years the global economy has undergone many transformations due to emerging markets such as China and India. The Australian Infrastructure Fund allocation has undergone a major change over the last decade with the majority of funding sources being diversified between a number of projects and sectors ranging from Telecommunication to Transportation.

The economic climate in the past decade has proven to be challenging and demonstrated fiscal strain. The Global Financial Crisis (GFC) has evidenced this apprehension of current and future directions. Locally there was disruption to the private sector funding of large infrastructure projects, which in turn has reduced current infrastructure growth in Australia to near nothing, despite having $380 billion worth of current projects in the pipeline. (Gharehbaghi 2009)

This paper comprises an analysis of the current and prospective efficiency and effectiveness of proposed method in achieving innovation and cost effectiveness regarding project delivery in infrastructure. The purpose of this paper is to draw attention in relates to outcomes of finance for large and complex civil infrastructure projects.

1. Introduction

In the early years of infrastructure projects, Governments have always played the predominant role in owning and operating infrastructure facilities as they have been the sole financier of these projects and have often taken responsibility for implementation, operations and maintenance. As many global economies are facing challenges there is an increase stress on infrastructure requirements to control costly overruns and minimise delays. As a result Governments have often moved to privatisation of public civil works to mitigate risk.

(Gharehbaghi, 2006) Provision of infrastructure has traditionally been to preserve

K. Gharehbaghi, RMIT University, Melbourne, Australia
V. Raso, RMIT University, RMIT University, Melbourne, Australia
the public sector. Funds for the development of the infrastructure projects are traditionally obtained from general taxation or borrowed from multi-lateral and bilateral agencies. This traditional method of public finance and management of infrastructure projects have failed to keep pace with the rising demand today (Gharehbaghi, 2006).

Over the last two decades there has been a dramatic shift in successive governments’ approach to public sector procurement, with the private sector assuming greater responsibility for matters of finance, design, construction, operation, management and maintenance. The measure of a successful infrastructure project is financing and delivering the project on budget and on time. Project finance is to be defined as the following:

“financing the development or exploitation of a right, natural resource or other asset where the bulk of the financing is not to be provided by any form of share capital and is to be repaid principally out of revenues produced by the project in question”(G.Vinter 1995, xxvii)

The delivery of projects is performed using mainly traditional processes that have evolved historically and the industrial revolution, where specialisation of professional organisations was the key trend (Pakkala, 2002). This means that architects, engineers, specialty contractors and the industry have adopted a segmented rather than an integrated type of process. The responsibility and the financing sources have changes and this change has had implication on documentation and added significant burden of risk to a single party.

In accordance to the US department of transport, It is evident from demographic figures and trends within the United States of America’s infrastructure systems that deterioration of civil services are at the point where the country’s future economic competitiveness is in jeopardy. Merna and Njiru (2002), suggest that this partly due to American society, as they have failed to maintain or improve its infrastructure system for the past 20 years. Financing of Large and Complex Civil Infrastructures Projects are governed by the availability of funds with tens of billions of dollars needed across many sectors of infrastructure and projects.

The Australian Paradigm

The challenge of financing and management of infrastructure projects can be attributed to many forces and factors. On such factor that carried over since 2007 is the Global Financial Crisis (GFC) which disrupted private sector funding of large infrastructure projects, and in turn has reduced current infrastructure growth in Australia to near nothing, despite having $380 billion worth of current projects in the pipeline. (Government). Hence the financing of such large and complex civil infrastructure projects are vital aspects of any successful economy, which need to be carefully considered for all infrastructures types have a design life and an actual useful life.

The current transport system in Australia is a perfect example of infrastructure design life and its useful life. The transport system was designed in the mid 1950’s
for approximately one third of the current population and despite many upgrades such as new and additional carriages; the current transport system has come to the end of its useful life, which is why the funding has been aimed at this sector. Australia is currently developing a telecommunications network that will deliver high speed broadband to 100 percent of Australian premises. This network is known as the National Broadband Network or NBN. The NBN uses a mixture of fibre optics, fixed-wireless and satellite technologies and is the first national wholesale-only, open-access broadband network. The network will gradually replace the existing copper network that was originally owned by Telstra and currently being used for most data and telephone services.

The service is to be constructed over a ten year period and cost approximately $35.9 billion. NBN Co was established by the government to design, build and roll out the NBN. The Australian Government has also invested $250 million in a commitment to fill in backbone black spots throughout regional Australia.

This investment has improved several areas which include:

- An immediate economic stimulus,
- Reduced cost of broadband services and,
- Allowed for key infrastructure to be put in place for the rollout of the NBN.

The benefits of investing in infrastructure may not be directly seen, but include the following (Gharehbaghi, 2006):

- Labour productivity – reductions in time wasted commuting to work and the stress of travelling.
- Impact on human development – numerous studies have found that infrastructure advancements create improvements in both health and education, by increasing labour productivity and inducing increased investments in the education system.
- Strong demand – constantly rising populations means there is need for essential infrastructure even in times of slow economic growth.
- Steady returns – over a long period of time are highly attractive to pension funds and life insurance companies who can match these returns to long term liabilities.
- Funding these large complex projects is difficult to attain and maintain, hence an exact costing method is required to save the cost where ever possible.

**Figure 1: Infrastructure Paradigm**

Source: Gharehbaghi
The Infrastructure Paradigm can be categorised into two specific areas; Economic and Engineering. The economic includes all the relevant monetary and fiscal issues whilst the Engineering deals with the techniques and technologies involved in design and construction of the infrastructure projects.

2. Literature and Discussion

2.1 Source of Project Finance

Project financing is extensively used in Australia as many large projects require continuing amounts of investment with the source of finance playing a major role in determining the success of financing and delivering infrastructure project. Gharehbaghi, (2006) identifies that many of the major infrastructure projects of the past 30 years could not have been undertaken without project financing. However, diverse outcome in lack of funding occurs in the use of infrastructure procurement, which arise from government perspective (public sector), but also private sector. Such outcomes are not caused by a single issue, but multi obstacles, such as tax rate and the risk assessment for expected shortfalls in revenue.

The discussion and literature review summarises the views expressed in theory with relation to how inappropriate funding in the use of infrastructure procurement can be allocated across public and private sectors for infrastructure projects.

2.2 Government (public sector)

Governments play the predominant role in owning and operating infrastructure facilities, they have been the sole financier of projects and have often taken responsibility for implementation, operations and maintenance as well. In general, it is less satisfactory than the alternative of competitive enduring (Dalla, 2011).

There is a gradual recognition that this may not be best way to execute/finance projects, based on considerations such as cost efficiency, allocation efficiency and fiscal prudence, where predominant cause for such delays / overruns was not under-funding of the projects, but arose, on account of clearances, land acquisition problems, besides factors internal to the entity implementing the project.

There is a need for capability building within the government sector for infrastructure planning, procurement and project management (Mallesons, 2008). There is also a need for lessons to be syndicated across government on issues such as success and failure of public and private procurement and contingency planning for default in private projects (Delmon, 2010). The building of appropriate skill across government should become a key objective of infrastructure policy makers.

The government believes that a rigorous economic assessment is important to ensure that the right procurement option is chosen on the basis of value for money. Through the findings of Delmon (2010) it shows that infrastructure investment guidelines for Victoria reflect a strong financial need. The challenge of difficult economic times and national economic policies has reduced infrastructure spending
to its lowest level, which means that these vital investments cannot be met by government alone.

Government believes that the infrastructure investment policy for Victoria suggests that increased private involvement can drive growth and efficiency, where the Victorian Government is committed to the pursuit of growth and efficiency. It believes that this will be facilitated if the private sector participants to a greater extent in the provision of infrastructure and related services.

2.3 Private Sector

Delmon (2010), state that privately implemented and managed projects are likely to have a better record of delivering services which are cheaper with higher quality compared to public sector. It is suggested that the private sector has more reliable skills in project delivery with better funding strategies. The private sector demonstrates advanced skill in risk allocation, is well experience in certain works and generally has more sophisticated equipment. However, Jain, (2009) finds that private sectors are not likely to place their skills and attitude in infrastructure projects since it always refers to government project.

The willingness of private sector investors and lenders to develop public infrastructure projects depends greatly on the environment where these projects operate. For example, they are hesitant to pursue projects in an environment where local authorities are viewed as having poor credit quality and contracts are not easily enforceable. Xueqing Zhang (2005) believes that private sector participants play a paramount role in the successful implementation of particular infrastructure projects in risk allocation and reduce pressure of funding the projects. One risk which cannot be allocated to the private sector is that government may contract with an unsuitable partner.

Delmon (2010) also addresses that as public and private sector have advantages in diversity of strength in delivering infrastructure projects. It is worthwhile seeking an innovative and cost effective ways to deliver infrastructure projects by joining public and private sector as joint venture. Partnership Victoria (2001), the question is whether a relationship between government and the private party can be sustained over the longer term. Delmon (2010) suggested this depends not only on the probity and stability of the private party, but also on the willingness of the parties to cooperate to resolve difficulties, and the creation of a genuine business opportunity for the private party.

Projects proceeding on the basis of an exceptionally low bid from an inexperienced bidder are unlikely to deliver true value in the long term. The main ingredients of partnership should include:

- Planning and specification, so that government's desired outcomes and output specifications are clear to the market.
- A genuine and viable business opportunity, for the private party.
- Certainty of process, so that any conditions to be fulfilled are clearly understood before the project proceeds.
- Balance bid evaluation, based on more than simply financial comparison.
- Project resourcing, to enable government to advance the project and address issues in line with published timeframes.
- Clear contractual requirements, centred on key performance specifications, to promote performance and minimise disputes.
- Contract management to monitor and implement the contract.
- Recognition of the partnership to encourage good faith and goodwill between government and the private party in all project dealings.

Below figure indicates the theoretical frame work between the dependent variables (problem arises while delivering an infrastructure project), with independent variables; which are fundamental issues in large and complex civil infrastructure projects.

**Figure 2: Infrastructure theoretical frame work**

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Independent Variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problem arises while delivering an infrastructure project</td>
<td>Source of Finance</td>
</tr>
<tr>
<td></td>
<td>Project Performance</td>
</tr>
<tr>
<td></td>
<td>Delivery Method</td>
</tr>
</tbody>
</table>

The theoretical framework is extended to include the secondary problems within three main groups (specifically for large and complex civil infrastructure projects) is illustrated below in Figure 3.

**Figure 3: Extended Infrastructure theoretical frame work.**

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Independent Variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problem arises while delivering an infrastructure project</td>
<td>Source of Finance</td>
</tr>
<tr>
<td></td>
<td>Government</td>
</tr>
<tr>
<td></td>
<td>Private Sector</td>
</tr>
<tr>
<td></td>
<td>Project Performance</td>
</tr>
<tr>
<td></td>
<td>Project Cost</td>
</tr>
<tr>
<td></td>
<td>Time</td>
</tr>
<tr>
<td></td>
<td>Quality</td>
</tr>
<tr>
<td></td>
<td>Delivery Method</td>
</tr>
</tbody>
</table>
3. Overall composition of Financing of Large and Complex Civil Infrastructures Projects

Infrastructure is the basic physical and organisational structures needed for the operation of a society or enterprise, or the services and facilities necessary for an economy to function. Developed countries give development aid to developing countries to support their long-term economic, social and political advancement. Infrastructure development is the key component to any type of growth in all countries.

While infrastructure development is essential, it can have devastating impacts that are not always considered during the planning phases. It was not until the end of the 1990’s that Australia recognised the importance of infrastructure due to the emergence of other countries such as China and India. An annual report from the Australian Infrastructure Fund (AIF) which was released in June of 2002 stated that the Australian Infrastructure Fund had allocated 59% of its whole infrastructure funding to Airports and a total of 89% to the Australian transport system.

In analysing the annual report from the Australian Infrastructure Fund (June 2011) it indicates that fund has increased its airport portfolio to 94.4% of the total transport infrastructure allocations. This clearly shows intent of not only upgrading the Australian transport system, but also its trade ability.

The Australian Minister for Infrastructure recently outlined that in the globalised world of the 21st century, prosperous nations will be those with well-planned future-proofed infrastructure (Government).

3.1 Transport Grids and Systems as an example of Large and Complex Civil Infrastructures Projects

Transport is a key component of any economy and its development and is increasing daily. It predominantly relies on a single fossil resource, petroleum that supplies 95% of the total energy used by the world transport. In 2004, transport was responsible for 23% of world energy related greenhouse gas emissions with nearly 75% coming from road vehicles.

In 2012 we have had major advancements in our transport methods, especially road vehicles. Road vehicles have evolved into hybrid vehicles, which combine a dual fuel source of petroleum and rechargeable lithium ion batteries. This has reduced the emissions emitted by road vehicles by 46% and can reduce fuel consumption by more than half.

Australia’s rail network has also undergone major changes, it has replaced its steam and coal powered rail network with a very efficient electricity powered network that runs at nearly 90% efficiency daily.

Australia’s current rail transport system has unfortunately come to the end of its useful life. Beginning year 2012 Melbourne’s public rail transport system was overtaken by Metro, with an immediate aim of increasing the current efficiency to a minimum of 95%. Although it is currently achieving its aim at providing 95%
efficiency, the rail network is running at its maximum performance level and is still unable to cater for the rapidly growing population in Melbourne. The Australian Federal Government has recently outlined that it intends on upgrading the public transport system by giving it a complete overhaul and replacing old carriages with new ones and creating a new rail link to the Tullamarine and Avalon Airports.

In the past decade the Australian government on all levels has invested in infrastructure and this is evident within the Melbourne market where the construction of two of the biggest infrastructure advancements in the country was implemented. (These being EastLink and CityLink) These were major links which gave the outer Melbourne suburbs quick and easy access to the heart of the city. CityLink is a 22 kilometre automated tollway linking the Southern and Western suburbs of Melbourne to the heart of the city.

It connects the Tullamarine Freeway, the West Gate Freeway and the Monash Freeway to the south. EastLink is Melbourne’s second fully automated tollway and it is a 39 kilometre motorway connecting the Eastern Monash and Frankston Freeways and the new Peninsula Link. The significance of these tollways and infrastructure project is in the reduction of travel times for many outer eastern commuters by up to an hour as well as creating numerous wetlands and new biodiversity homes to over 35,000 wildlife species. (Citylink 2012)

4. Conclusion:

The focus of this paper was based on the complex financial issues for large a complex civil infrastructure projects, including transportation grids and systems.

The major issue cause suspension of the project usually refers to source of finance. As mentioned in this article, the project outcome is less satisfactory where the government has been the sole financier in the past of infrastructure projects and has often taken burden and responsibility for entire works including implementation, operations and maintenance, where it leads to predominant cause for delays. Overruns were not purely due to under-funding of the projects, as they arose, on account of clearances and land acquisition matters. These are factors internal to the entity implementing the project. According to the findings of Delmon (2010), it shows that infrastructure investment guidelines for Victoria reflect a strong financial need. The challenge of difficult economic times and national economic policies has reduced infrastructure spending to its lowest level, which means that these vital investments cannot be met by government alone.

Generally, large infrastructure projects are loan-finance and made up the major share of investment and financing from alternative sources have crucial connections for project’s overall cost, durations, cash flow and claims to project incomes and assets. However, such issues and shortfalls are taken into account and well managed in Eastlink project by two major sources of finance – debt and equity, where debt is the capital borrowed from banks and other financial institutions, which has a fixed maturity and fixed rate of interest paid on the principal.
In order to attract and manage involvement of investors, commitment of equity for project finance always comes with a designated rate of return. The rate is generally greater than the interest rate of loaned capital from banks and other financial institutions, which compensation is made equal to the risks burden undertaken by the investors as they have junior claim to income and assets of the project.

In conclusion, the overall fiscal settings and economics of large and complex civil infrastructure projects, is a difficult task, one which requires the significant finance not only from the government but also the private sector too, hence providing an improved and efficiency in overall monetary spending.

This paper comprises an analysis of the current and prospective efficiency and effectiveness of proposed method in achieving innovation and cost effectiveness regarding project delivery in infrastructure project. The main purpose of this paper is to draw attention in relates to outcomes of finance of large and complex civil infrastructure projects.

References