Sustainability Indicators for a Transportation Infrastructure Investor

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Abstract

Sustainability of infrastructure has been a source of concern for ages. A panoply of literature exists on sustainability. However, few studies exist which focus on the sustainable outcomes which an infrastructure investor seeks when deciding to invest in a project. The current study reviews extant literature to identify factors which are indicative of sustainability, specifically to an investor. Transportation literature is focused on because of its economic nature and potentiality of returns to an investor. Studies in both international and South African context are included. Findings revealed that adequacy of funding, accessibility, safety and security, quality, reliability, environmental friendliness and strong institutions are desirable outcomes to an investor. These findings will assist in the development of strategies to ensure that infrastructure projects are financially and economically sustainable.

Keywords

Infrastructure, investment, investor, sustainability, transportation

1. Introduction

Infrastructures, in different forms including technological networks, transportation, and health care systems, are critical to the development and growth of any economy (Huang et al., 2014). Infrastructure development's impact on economic growth is significant as no economy can achieve high, sustained growth without the right infrastructure (Financial and Fiscal Commission (FFC), 2016; Department for Infrastructure Development (DFID), 2017). Transportation infrastructure in particular, provides for personal security, economic stability, public health and quality of life benefits (Pollalis, 2016). The failure of infrastructure may therefore be hazardous to the general population, the economy and even security (Huang et al., 2014). Thus, sustainability of infrastructure in terms of balanced costs and benefits as well as financial returns is desirable (Pollalis, 2016).

The sustainability of transport infrastructure projects in terms of leveraging maximum possible funding from the available sources while preserving and maintaining existing assets for future generations has been a focal attention for decades (Development Bank of Southern Africa (DBSA), 2012). Although sustainability of infrastructure has generally been regarded as the incorporation or realization of social, economic and environmental objectives in infrastructure development, other aspects of sustainability such as institutional and physical and importantly, financial sustainability are essential in transportation infrastructure development.

Given the long-term nature of transport infrastructure investments, financial sustainability is critical for investors (Hristova, 2015). The long economic life of infrastructure assets makes investors exposed to risks. Therefore, low risks and high certainty of periodic cash flow are primary considerations at the

time of infrastructure planning (Blackrock, 2015). Investors typically seek long-term predictable yield-to-duration to match future liabilities/risks, costs and payments. Moreover, sustainability is a positive public good which must provide clear benefits and be financially obvious (Pollalis, 2016). Financial returns are particularly important in transportation infrastructure sustainability due to its economic nature and potential of revenue to an investor. Certainty or assurance about the stability of investments means less risk and decreases return requirements (Blackrock, 2015). Therefore, tools are needed to ensure that infrastructure projects are planned with the intent of attaining sustainability.

Studies on transportation infrastructure sustainability abound (Zou et al., 2011; Kaare and Koppel, 2012; Montgomery et al., 2015). However, most literature focus on the three-dimensional aspects (economic, social and environmental) (Litman, 2016). Although Haas et al. (2009) and Karlaftis and Kepaptsoglou (2012) acknowledged that infrastructure sustainability performance indicators may vary among stakeholders due to differing interests, they focused on road transport projects and included all stakeholders. Few studies have focused sustainability concerns of transportation infrastructure investors only. The current study therefore aims to fill this gap by identifying sustainability indicators which are important to an infrastructure investor to provide assurance of the worthwhileness of a proposed investment.

The objective of the current study is therefore to develop framework of sustainability indicators relevant to an investor in transportation infrastructure projects. Extant studies are reviewed, and the findings are presented in a matrix of sustainability indicators. The methods used to undertake the study are briefly described hereunder. The findings, and conclusions are presented thereafter.

2. Transportation Infrastructure Sustainability

2.1 Overview of the sustainability concept

The World Bank defines sustainability as the ability of a project to maintain an acceptable level of benefit flows through its economic life (Khan, 2000). It is the ability of a project to maintain its operations, services and benefits during its projected lifetime (Khan, ibid.). Transport infrastructure should be planned, designed, constructed, operated and maintained using best practices that sustainably integrates environmental, community and society, and economic attributes and promotes efficiency, safety, longevity, cost-effectiveness, community values and priorities (Ramani *et al.*, 2009; Montgomery *et al.*, 2015; Pollalis, 2016). The goal of sustainable transportation is to ensure that environmental, social and economic considerations are factored into decisions affecting transport activity (Corttrill and Derrible, 2015). Unsustainable activity is defined as "one which cannot continue to be carried on the way it is now without serious difficulties" and with regard to transportation infrastructure, this includes costs that transport systems pose to humans and the environment such as pollution (Oswald and McNeil, 2010).

There appears to be a general consensus on the need to achieve economic and social development and protect the environment, that is, the three basic dimensions (Zavrl and Zeren, 2010; Bueno *et al.*, 2015). However, the Commission on Sustainable Development of the United Nations (UNCSD) defined sustainability as having four dimensions, namely, economic, social, environmental and institutional (Brouwer and van Ittersum, 2010). Thus, institutional sustainability has been added as an indicator and this is especially important where multiple ministries, government departments and agencies at different levels of government are involved such as in the transportation infrastructure sector (Quium, 2014).

2. Indicators of infrastructure sustainability

Infrastructure sustainability can be measured using indicators or performance measures (Dhingra, 2011). Indicators are measures that provide specific information about the properties or attributes of a system (Cottrill and Derrible, 2015). Performance measures relate to how well a system is fulfilling or meeting its

set of predicted goals and objectives and thus can be used in the case of transportation infrastructure sustainability measurement (Dhingra, 2011).

Sustainability indicators evidenced from rating systems such as CEEQUAL, LEED, Greenroads™, Envision ™, and so on, include environmental preservation, community impacts, health and safety, efficiency, financial sustainability, infrastructure resilience, economic development and land use, multi-modal transport, accessibility, affordability, travel demand, and pollution (CEEQUAL, 2007; Bueno *et al.*, 2015; Pollalis, 2016). However, most of the rating systems are usually regionally based and incorporate context-sensitive sustainability elements of the location where conceived (Bueno *et al.*, 2015). Thus, it is necessary to review and identify specific factors used to measure sustainability in related infrastructure sectors.

2.2.1 Sustainability indicators in the transport infrastructure sector

Sustainability of transportation infrastructure includes aspects related to accessibility, mobility, reliability, asset value, comfort and convenience, operational efficiency and effectiveness, positive public opinion/acceptability, travel experience, demand, safety, quality, improved socioeconomic conditions (boosting local productivity), integration of land use (balance) (Ramani et al., 2009; Henning et al., 2011; Montgomery et al., 2015; Litman, 2016; Barnes-Dabban et al., 2017; World Bank, 2017). Greenhouse emissions, congestion, accidents and pollution are also reflective of transport sustainability (United Nations (2015). The US Chamber of Commerce (2010) identified that supply, quality of service, safety, quality (structural deficiency) and utilization are criteria to measure transport sustainability performance. Likewise, Haas et al. (2009) found that safety, mobility and speed, reliability, environmental protection, productivity, user benefits, asset value, comfort and convenience, program delivery, operational efficiency were measures of road sustainability performance in international practice. Other studies included institutional sustainability as an important aspect (Jeon et al., 2010; Cottrill and Derrible, 2015; Barnes-Dabban et al., 2017).

Numerous factors have been identified as indicative of infrastructure sustainability. However, due to the economic nature of transport infrastructure, the relevant indicators are mainly economic and financial returns. Moreover, some indicators exist for different stakeholders as opined by Haas et al. (2009), Henning et al. (2011) and Karlaftis and Kepaptsoglou (2012). Therefore, selection of practicable and relevant factors relatable to transport infrastructure and for an investor is essential.

2.2.1.1 Investor-centered sustainability framework

An investment can be defined as having four elements, including a contribution of money; a certain duration; an element of risk; and a contribution to economic development (Grabowski, 2014). Thus, an investor, who could be either a natural person (individual) or legal persons (companies or businesses) (Nikièma, 2012), parts with money in the hopes of getting profits. Thus, more certainty about the stability of investments means less risk and decreases return requirements (Blackrock, 2015).

An investor's interest in and allocations to infrastructure are driven by a combination of factors such as low yields in traditional asset classes, potential link to other assets, stable cash flow/yield, and inflation protection and investment performance through the entire economic cycle (Mercer and Inter-American Development Bank (IDB), 2017). Infrastructure investors are interested in risk-adjusted returns as well as environmental and social outcomes (Mercer and IDB, 2016). There is an acknowledgement that strong due diligence inclusive of environmental, social and governance factors tends to reduce risk (Mercer and IDB, 2016).

Therefore, it is important to an investor, for instance, to recoup the capital injected into the project, in addition to conditions (including social and environmental and governance) which do not compromise

returns as expected. This suggests that in the context of transport infrastructure investments, investors, who have alternative and sometimes conflicting ideas on projects to invest in, need to be confident about the decisions they make regarding the investment options they choose. Assurance of liquidity over a certain number of years is important since they should be in no doubt about the sustainability of the project. Transport infrastructure investors are interested in investments which guarantee risk-adjusted returns, inflation protection and/or match specific investment requirements as well as environmental and social outcomes (Mercer and IDB, 2016; 2017). This suggests that investors are interested in cash flow as well as favorable conditions (including quality) and frameworks (institutional) which guarantee sustained financial returns.

Consequently, a more rigorous synthesis of literature which focused on investors' interests was undertaken. It was found that although some factors are important in sustainability assessments, for instance, pollution and environmental protection, investors generally are not prepared to take lower returns on their capital to achieve the social and environmental impacts on the projects. The only exception is the case of impact investment, whereby investments are intended to create positive social impact beyond financial return (Jackson, 2013). Impact investment is made with specific and evident environmental and/or social returns, irrespective of the risks to financial sustainability, more especially in "impact first" investments (Hebb, 2013; Jackson, 2013). Therefore, it has been observed that transportation infrastructure investors typically invest with an aim to attain the following sustainability aspects including adequacy of funding, affordability, accessibility, safety and security, quality/standard of physical infrastructure, reliability, environmental friendliness/preservation and strong institutions. These are presented in the matrix in Table 1 and discussed further hereunder.

Adequacy of funding – This has to do with sufficient funds to cover the capital invested (cost recovery), expected cash income (financial reward) accruing to an investor as and when due, administration costs, and expenditure to maintain, expand, repair or replace capital infrastructure facilities to required standards, over the life cycle of the infrastructure (World Bank, 2013; Liyanage et al., 2015; IBNET, 2017).

Affordability – This has to do with ability to pay transport bills, taxes, tickets, and other charges (IBNET, 2017). Affordability is classified in some literature as a social factor (World Bank, 2013; Litman, 2016), and in others as an economic aspect of sustainability (Jeon et al., 2010). However, it can be argued that since it involves parting with money in order to fulfil a need, it is an economic aspect.

Accessibility – Accessibility is defined in terms of ease of getting to the transport facility from the most remote location within the catchment area (Henning et al., 2011). This has to do with fulfilling the basic need of access to and from destinations, by all citizens irrespective of income, location, or personal situation (Government of Sweden, 2016; World Bank, 2013; 2018).

Sa*fety and security* - Safety includes accidents risks such as accidents, fatalities, injuries and incidents (European Transport Safety Council (ETSC), 2016). It also includes existence of safety management programs (Karlaftis and Kepaptsoglou, 2012). Security data include crime statistics and perceived security from patrons (World Bank, 2013).

Quality/standard - This has to do with network performance in terms of quality or state of maintenance, breakdowns/potholes, frequency of maintenance (Karlaftis and Kepaptsoglou, 2012; IBNET, 2017). Good quality infrastructure leverages the optimum possible funding for an investor as people will be willing to pay for its use (Ramani et al., 2009).

Reliability - Reliability appeared to be the factor with the most consensus among the reviewed literature. Reliability is defined as the ability of fulfilling a function successfully. Reliability means that systems are in a condition to be able to accomplish a predetermined function during a prescribed period of service (Nagae and Wakabayashi, 2015). It includes aspects such as connectivity, capacity to bear demand, travel time savings, and resilience (Friedrich and Timol, 2011; GoS, 2016).

Environmental friendliness/preservation – This includes pollution levels, preservation of the natural landscape, efficacy of monitoring and evaluation and control policies (Ramani et al., 2009; (Karlaftis and Kepaptsoglou, 2012; World Bank, 2013; National Geographic, 2016).

Strong institutions - Institutional aspects cover various legal, governance, administrative, institutional, management and other non-technical aspects and arrangements, which serve as basis for decision-making (World Bank, 2013; Quium, 2014). These include legislation, management structure, resource allocation arrangements, project champions, clarity of responsibilities, incentive frameworks, efficiency of operations, and interaction among partners (World Bank, 2013; 2014; Upadhyaya et al., 2014; Cottrill and Derrible, 2015; Barnes-Dabban et al. 2017).

Table 1: Summary of key sustainability indicators

Author	Year of publication	Sustainability indicators							
		Adequate funding	Affordability	Accessibility	Safety & security	Quality/standard/ condition	Reliability	Environmental friendliness	Strong institutions
Haas et al.	2009				X		X	X	
Ramani et al.	2009			X	X	X	X	X	
Jeon et al.	2010		X		X		X	X	
Oswald & McNeil	2010		X	X	X		X	X	
US Chamber of Commerce	2010				X	X	X		
Henning et al.	2011	X		X			X		
Karlaftis and Kepaptsoglou	2012	X		X	X		X		
World Bank	2013	X	X	X	X		X		X

Upadhyaya et al.	2014	X				X	X		
World Bank	2014	X	X	X		X			X
Cottrill & Derrible	2015	X		X	X	X	X	X	X
DoT	2015					X	X		
Montgomery et al.	2015					X	X	X	
UN	2015	X			X			X	X
GoS	2016		X			X	X	X	
Litman	2016		X		X				
Mercer & IDB	2016	X							X
Barnes-Dabban et al.	2017						X	X	X
IBNET	2017	X	X	X		X	X		
World Bank	2017						X	X	
World Bank	2018	X	X	X	X			X	

3. Summary and Conclusion

The study sought to identify factors which are indicative of infrastructure sustainable performance from the view point of an investor who primarily seeks financial returns from the investment, albeit social and environmental and other economic factors cannot be overlooked. Thus, the objective of the study was met. The study found that an investor may be interested in risks adjusted returns and the conditions which can ultimately ensure that have to be in place to achieve sustainable performance of transportation infrastructure projects in terms of adequacy of funding, affordability, accessibility, safety and security, quality, reliability, environmental preservation, and strong institutions.

Continuity and security of funding for asset maintenance is crucial because without due attention to the physical infrastructure, the services and structures will eventually deteriorate. Poor quality infrastructure is detrimental to an investor as it results in low demand for services provided by the subject project. Monitoring and evaluation policies are critical to ensure risk-adjusted returns on infrastructure investments and environmental protection simultaneously. The effectiveness of institutions responsible for implementing such policies reflects sustainable performance. Efficacy of institutional frameworks helps in transparency and communication of information on long-term infrastructure pipelines and other potential projects and thus leading to proper estimation of infrastructure needs. Moreover, unfavorable regulatory frameworks pose risks to an investor and can have a depressing effect on infrastructure investment by increasing uncertainty in the eyes of investors.

Although the study is a literature review, these findings provide valuable evidence base for an investor to assess the worthwhileness of proposed projects during decision-making to invest. Further studies can employ primary research techniques to investigate the level of important of these factors among investors.

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