The predicaments of Environmental Impact Assessment (EIA) for Transport Infrastructure: An examination of policy stagnation and progress

Abstract

Purpose – Environmental Impact Assessment (EIA) for transport infrastructure, should consider geological constraints, legislative regulations, public policy, and other strategic considerations. These strategic considerations and constraints that are often seen as the most challenging issues facing transportation planners are critically reviewed. Subsequently, the evolving environmental impacts of civil transport infrastructure projects are measured.

Design/methodology/approach – Using a mixed-method approach, this study examines the EIA and Environmental Impact Statement (EIS) dimensions of transportation infrastructure.

Findings – Through the development of the EIA and EIS policy framework for transport infrastructure, this paper found that to better enhance the EIA and to effectively calculate various indicator variables, a hybrid approach to the method, known as input-output analysis, needs to be adopted. Knowing that a feasible cost breakdown is usually available within projects, it can be concluded that it is plausible to add an I-O model into an existing environmental impact statement to obtain results not only for onsite effects but also for off-site effects. Moreover, some of the benefits of implementing a hybrid input-output analysis can (1) significantly improve the completeness of any conventional EIS for a range of quantifiable indicators, (2) improve the ability to rank alternative options, and (3) provide a valuable overview of indirect impacts to be used for streamlining the EIA audit. For these reasons, input-output techniques could be incorporated as optional elements into the EIA standards.

Practical implications - With input from the Australian Bureau of Statistics (ABS) and national input-output tables of the industry sector, this research was able to determine that indirect effects within transport projects are not being considered for what they are worth. This enables to answer key questions dealing with the effects of EIAs on the transportation sector. This in turn can assist with planning through the commissioning of such projects.

Originality/value - The I-O model introduced in this paper will ultimately lead to better incorporation of various environmental elements. The findings of the paper can thus assist transportation planners in better aligning environmental impacts with EIA. This in turn can result in improvements in the completeness of any conventional EIS, enhance the ability to rank alternative options and provide a valuable overview of indirect impacts to be used for streamlining the EIA audit.

Paper type - Research paper

Keywords: Environmental Impact Assessment (EIA), Environmental Impact Statement (EIS), Civil Infrastructure Project, Policy Framework.

1.0 Introduction and background

Civil infrastructure and large-scale developments that involve construction activities contribute a significant amount to countries' economic growth, social patterns, and environmental quality. Nonetheless, there are still many environmental implications regarding the construction of these projects (Odolinski and Boysen, 2019). The construction of transportation, whether rail, road, marine, or air, imposes a high risk of damage to the bio-psychical environment. Several of such megaprojects are disruptive to the natural environment impacting aspects such as biodiversity, soil, water, and resulting in air and climate pollution (Gounder, 2008). These impacts are largely inflicted on humans, flora, and fauna, and this is a rising concern. Moreover, environmental implications may also hurt wider stakeholders, affecting the social pillar of sustainability (Jain et al., 2020). Wang, Yang, and Quintero (2012) argue that the remaining challenges include addressing accumulated impacts, improving the quality of public consultation, and integrating social mitigation measures to protect the environment.

Sustainable measures and practices must be carefully considered in the design and implementation phases of construction and infrastructure projects (Cascajo, 2004). Therefore, most projects need to invest in highly detailed documentation of their Environmental Impact Assessment (EIA) and Environmental Impact Statement (EIS). Transportation networks facilitate sustainable modes of transportation, compared to road transportation which has a significantly higher impact on the environment. Rail transportation has less of an impact on the environment compared to other transportation modes, yet the initial problem lies within the construction of these megaprojects (European Commission., 2012). The MetroTunnel (2017) through the evidence of global warming and the emissions of harmful greenhouse gasses such as carbon dioxide, highlights that rail is a far cry at 8% contributor compared to 70% from the road. The potential implication of these projects can be identified through case studies into the development of the Sydney Second airport and Sydney metro rail projects and various other forms of construction worldwide.

Research aims

It is without a doubt in the best interest of organizations, governments, and project developers to provide a detailed description of all local and project-specific environmental (whether direct or indirect) impacts within their EIA. It would also be beneficial to include as many indicators that are not indirectly quantifiable or for which there is limited data available, to the best of their abilities, as this can enhance and provide and "present a valuable tool for long-term strategic planning of governments" (Lenzen et al., 2003).

This paper aims to focus on transportation air and rail network systems. The case studies analyzed for comparison highlight the significance of each area of concern. Using EIA statements and reports, this research attempts to identify rising impacts on the environment, and how implementing an enhanced EIA can potentially provide decision-makers with pertinent insights. Furthermore, this research was undertaken due to the negative impacts that the construction industry has on the environment. It is known that many of the processes are underpinning the ecological environment and not enough emphasis is being put on the broader notion of sustainability, thus causing many concerns such as air, water, and land pollution (Bamgbadea et al., 2011).

Several authors such as Fageda, X. (2021), Praharaj et al., (2018), and Lieske et al. (2018) among others, have highlighted the importance of EIA in completing transportation projects. This includes not only the presence of appropriate EIS but also the adaptation of the hybrid analysis approach. Furthermore, with regards to transportation policy improvement, EIS can be adopted for a range of quantifiable indicators to improve the ability to rank alternative options. This approach provides a valuable overview of indirect impacts, to be used for streamlining the EIA auditing (Leao et al., 2021; Praharaj and Han, 2019; Yigitcanlaret al., 2019; and Zawieska and Pieriegud, 2018).

Subsequently, to investigate the environmental implications that may arise during construction, EIA documentation for the design, implementation, and maintenance phases of the Sydney Metro and Sydney Second airport projects are investigated. These two projects are selected since they both are complex civil infrastructure projects with many environmental considerations. Such considerations range from complicated EIA to problematical EIS strategies. Accordingly, it can be argued that the findings of this study can be useful in dealing with other civil infrastructure projects.

In this paper, initially, the environmental impacts of transport infrastructure are outlined. After this, Section 2 provides a succinct review of the most relevant literature, while Section 3 presents the research methodology. As case studies, the Sydney Second airport and Sydney metro rail projects are then debated within Section 4. In the same Section, the overall results are also discussed which include the EIA and EIS policy framework for transport infrastructure. Finally, the conclusion and recommendations are conferred in Section 5.

2.0 Literature review

There are various techniques for sustainability, and environmental impact assessments (Hosseinian-Far and Jahankhani, 2015; Farsi et al., 2020). Morgan (2012), in a comprehensive review, outlines the history of EIA, its pertinent challenges, and heterogeneities practices since the 70s and its inception through the National Environmental Policy Act (NEPA). One of the key challenges highlighted by the authors is that EIA is heavily concentrated at the project level, in particular for mega projects, resulting in significant negative environmental consequences (Wood, 2014; Morgan, 2012). While EIA can be defined as a set of tools to assist in environmental decision-making, EIS on the other hand is a comprehensive set of government documents that outlines the environmental impacts of a proposed project (European Commission, 2012). Figure 1 represents a typical EIA framework.

Figure 1, a typical EIA framework. (Gharehbaghi et al., 2022).

As it can be noticed that a typical EIA framework covers a number of phases ranging from the identification of key parameters to governments' propositions. For complex civil infrastructure projects, the last phase may be seen as the most challenging process. This is since the final phase of the framework involves all governments at all levels to be involved. Thus, from a policy perspective, this could lead to many strategic challenges. Therefore, affects both short-term and long-term environmental monitoring and controlling regimes. Moreover, a typical EIA framework also includes not only collecting the most recent environmental information but also long-term impacts. Further, for complex civil infrastructure projects specific yet innovative set of evaluation elements needs to be established (Johnson, 2019). Such elements need to be specialized in the environmental impacts of such projects. Figure 2 shows the six innovative elements of reducing the environmental impacts of the civil transport infrastructure projects.

Figure 2, a taxonomy of reducing the environmental impacts of the civil transport infrastructure (adapted from Gharehbaghi et al., 2019).

Figure 2 represents a taxonomy of innovative elements for reducing the environmental impacts of the civil transport infrastructure. The classification is based on; (i) Materials implications and maintenance optimization, predominantly focusing on innovation in transport systems that are energy efficient, (ii) Logistic and planning optimization through improved planning techniques, (iii) Intelligent compaction particularly the use of automated and intelligent machines for soil compaction, (iv) Re-establishing vegetation via suitable earthwork sealing process that protects the surrounding area from erosion, and (v) Network management for operations purposes, to reduce the environmental impacts, largely during the construction phase. To ensure the taxonomy is maintained properly appropriate auditing will also need to be carried out. Auditing within the context of the EIA primarily describes the activity of checking for compliance with criteria of environmental approval, additionally, it serves as an internal review of environmental management practices by auditors and for this report, it is used for a site evaluation for environmental liability, i.e. land and soil contamination, as seen in a report that determines the nature and extent of contamination (Australian and New Zealand Environment and Conservation Council, 1992).

3.0 Research methodology

This study aims to answer the following research questions: First, what are the environmental implications that may arise during the construction, design, implementation, and maintenance phases of a civil infrastructure project. To further assist with responding to this question, a sub-question was posed, which is, what are the policies to better advance EIA and EIS strategies. Figure 3 represents the research process.

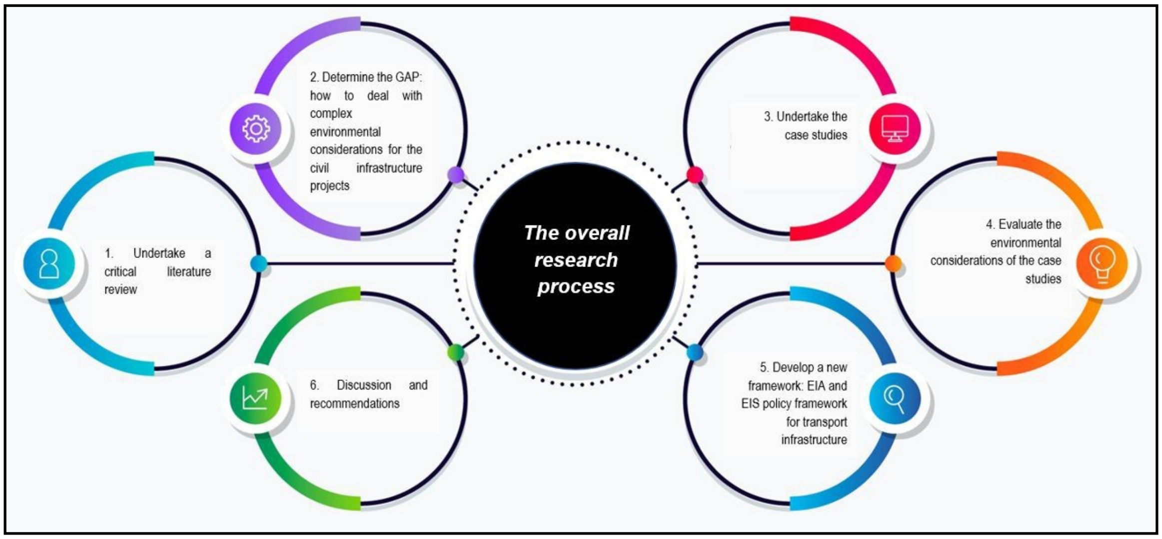

Figure 3, the research process.

As it can be observed the case study method was adopted for this study since it can closely highlight the significance of issues that are related to the environment. With the use of statistics and project outcomes, common denominators within cases can be found. As a baseline, this study focuses on the Sydney Metro development and commissioning. For such mega projects, a separate EIA in quantitative terms and specific modeling are developed.

A more in-depth look into quantitative information, particularly concerning the magnitude of an impact, can be compared with standards or thresholds which may establish acceptability or degree of severity. Thresholds can be obtained by similar cases to help distinguish realistic comparisons. Carpenter (1994) states that even subjective evaluation takes numeric or objective data into account to establish significance, i.e., on a broad spectrum if the focus was on the measurement of the complex ecosystem, there may be a different cause of significance e.g., the death toll of particular species of animals. Within the case study of Sydney's second airport and following the EIA process, probable impacts can be determined through relevant matrices.

Further, to best describe the overall approach and analysis of why this paper used the input-output model as a means of interpretation seen from the explanation below. Environmentally (extended) Input-Output Analysis “EIOA/EEIOA” (Kitzes, 2013) is an extension of the more established Input-Output Analysis (IOA), in which the metrics used are extended to incorporate the environmental dimension, as well as the conventional monetary considerations. EEIOA embraces pertinent metrics to consider the consumption, and related populations within the industry under consideration (Suomalainen, 2006).

The study conducted by Lenzen et al. (2003) further supports the adoption of this research means by combining the conventional EIS with a static input-output analysis model, to create a hybrid EIA approach. Detailed auditing is conducted to assess the direct environmental impacts, also known as on-site impacts, while the reaming higher-order requirements such as material extraction and manufacturing are addressed by input-output analysis. To further expand on this method, the first step to apply IOA is to understand the basics of this application. The input-output model in terms of economics is an adaptation of the general equilibrium theory which attempts to explain the behavior of supply and demand in interaction with various markets. As defined in the literature, the "input-output method is an empirical study of the quantitative interdependence between interrelated economic activities" (Gale, 2008).

3.1 Research methods and data sources

This paper aims to undertake an analysis of secondary data, using a mixed-method approach. The adopted case studies (Sydney Metro and Sydney Second airport projects) are used to explore qualitative and quantitative outcomes. Using a mixed-method approach, environmental information from the two case studies was compared and reported. The data was sourced from the Department of Transport for New South Wales (TfNSW) for the Sydney Metro and Western Sydney Airport Limited for Sydney's Second airport. TfNSW concurrently undertakes the development of many civil infrastructure projects throughout NSW. TfNSW enhances the experience of the communities through better project planning along with improved policies and regulation settings, e.g., the better alignment of EIA and EIS. Furthermore, the data used was based on the entire lifecycle of each project (Sydney Metro and Sydney Second airport projects), from inception through to the handover phase or near completion.

As the basis of data collection and analysis, specific variables were identified and used within the hybrid input-output analysis. These were Energy Consumption (PJ), Water Usage (gill), Employment, Land Disturbance (Kha), Greenhouse Gas Emissions (Mt) of nitrogen oxide (Kt), and Sulfur Oxide (Kt). The following list describes the variables and data sources:

- Energy is assumed as combustible geologic deposits of primary energy used from sources that are non-renewable such as coal. This includes solid, liquid, and gaseous fuels. Data was also gathered from the Australian Bureau of Agricultural and Resource Economics (1997).
- Water usage refers to and reflects net water usage obtained by, both main and surface water extracted from nearby rivers, lakes, and dams. Also, the Australian Bureau of Statistics and Water accounts for Australia (2000) were sourced.
- Land disturbance which refers to the ecosystem quality and conditions of an alternation, was assisted by accessing various New South Wales government reports.
- Greenhouse gas calculation was based on the Intergovernmental Panel on Climate Change (IPCC) and based on the original approach devised by the National Greenhouse Gas Inventory Committee in 1998 (IPCC, n.d.).

4.0 Results and discussion

4.1 Sydney Metro

Sydney is the largest city in Australia and the capital of New South Wales where approximately 4.3 million people reside according to the national census (ABS, 2017). The Sydney Metro is known to be Australia's largest public transport project (Gharehbaghi et al., 2020a), as defined in the Sydney metro 'final business case' 2016, it is estimated to have a cost range of $11.5 billion to $12.5 billion. This standalone railway network delivers 31 stations and 66 km of metro rail, with services starting from Sydney's northwest Rouse Hill to Chatswood, incorporating fully automated metro trains, and this was planned for the first half of 2019. To ensure proper construction and sustainable infrastructure, these guidelines aid in the process of construction. The EIS for the Sydney metro mega project incorporates the following issues in its environmental assessment; noise and vibration, groundwater and geology earthwork, soil, contamination of water and quality, and sustainable methods of construction (Gharehbaghi et al., 2020b).

For Sydney Metro, the environmental measures depended on the nature of the site activities and the sensitivity of the surrounding land and water environment. For instance, excavation work resulting in step slopes led to soil erosion and downstream water pollution, requiring incorporation of erosion protection measures as catchments for polluted water. Under the Environment Protection Act 1993, everyone has a general duty of care not to harm or in any way intentionally damage the environment by polluting. Within this context, pollution can refer to and include soil, water air, and noise pollution. Furthermore, Gharehbaghi et al. (2019) state the following factors that can determine the severity of environmental challenges faced in such mega projects as follows; (I) the unique natural features of urban areas-cities tend to take their form from the nature of their site and their environmental problems, (II) the diverse spatial dimensions of environmental problems in cities-spatial factors determine who is affected and the severity of impact, and (III) the roles of local actors, authorities and other key stakeholders.

For Sydney Metro, disturbances in environmental quality were raised from the results of decisions made by urban land use and urbanization planning. A scenario like this is rather critical, especially in developing countries, as 'ineffective urban land management strategies have resulted in the dilapidation of environmentally fragile land' (Gharehbaghi et al., 2020c). Therefore, there is a challenge to achieving a balance between urban development and environmental protection, considering the linkages between land use, poverty, and the environment (Bernstein, 1993; Guo and Liu, 2022). Land use has become so intensive over the last few decades that Kharel (2010) states that their implications can be noticed in the form of environmental complications such as pollution, loss of open space and biodiversity, and severe damage to the ecosystem. However, due to rapid technological advancements, exponential increases in population congestion, and increased demand for essential services, civil infrastructure has become an integral part of how society functions. This is directly correlated with the demand of the community, and the increased urbanization within Sydney which has put significant pressure on the public sector's ability to provide essential infrastructure services. Hence, there is an emphasis on developing a sustainable society (Gharehbaghi et al., 2019).

In contrast to what can appear as a barrier in the second stage of the Sydney metro mega project, the planned tunnel line under the harbor can face a dilemma similar to the case of the planned Sydney harbor tunnel road link which was completed in 1992 by Transfield and a Japanese company Kumagai Gumi. The problem for this particular project was that the hired engineering consultant prepared an EIS for the Sydney harbor tunnel that concluded that the project had little or no adverse environmental effects. However, this was later rejected by the department of environment and planning, since the 'benefits do not overweight the costs because there was an overestimation in travel cost and energy savings and indirect costs such as the loss of public transport patronage and the loss of parkland were not counted or were underestimated' (Muhammad, Low, and Glover, 2006). More importantly, the EIA 'did not adequately study the impact of the construction of the tunnel on the marine environment. For Sydney Metro, various matters of concern were complex excavation and fill including rock breaking, significant underground works including pilling and vibratory rolling, hazardous ground materials, and diversion of heavy construction traffic.

4.2 Sydney Second airport

Table 1 presents a comparative summary of results for the second Sydney Airport EIS and the input-output analysis carried out in the work.

Factor unit	Energy consumption (PJ)	Land disturbance (kha)	Water use (Gl)	Greenhouse gas emissions (Mt)	NO_x emissions (kt)	SO_2 emissions (kt)	Employment '000 (emp-y)
On-site, EIS	3.5[a]	2.5[b]	39.0	0.24[c]	3.5[d]	0.30[e]	8.4
Indirect, EIS							17.3
Indirect, IO	49.3	73.6	76.9	5.3	20.8	28.2	66.6
Total, EIS + IO	52.8	76.2	115.9	5.5	24.3	28.5	75.0

Table 1, Comparative summary of results (PPK Environment and Infrastructure, 1997).

The indirect effect can be seen to have a more profound effect on all the factors listed as the ratio between the onsite and offsite effects is significantly higher. By decomposing the fixed requirements into production layers by using the Leontief production function (Loentief and Ford, 1970), the following Figures are produced (Figures 4, and 5). These figures can therefore be used in another technique for decomposing input-output to identify the most important contributions to the production layers, also known as structural path analysis.

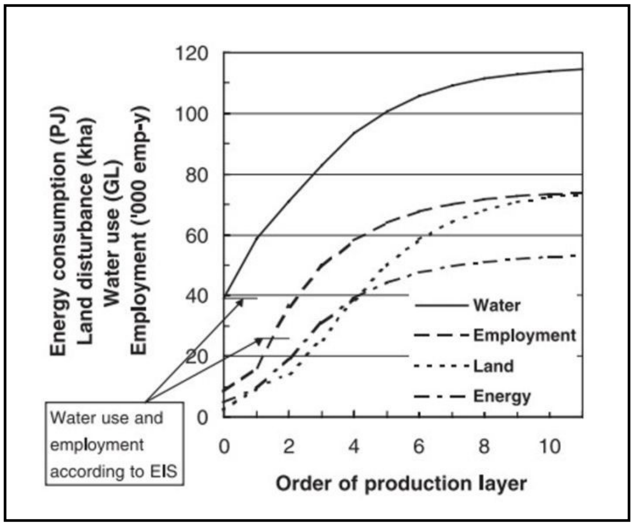

Figure 4, Energy consumption, land disturbance, water use, and employment as a function of production layer order (PPK Environment and Infrastructure, 1997).

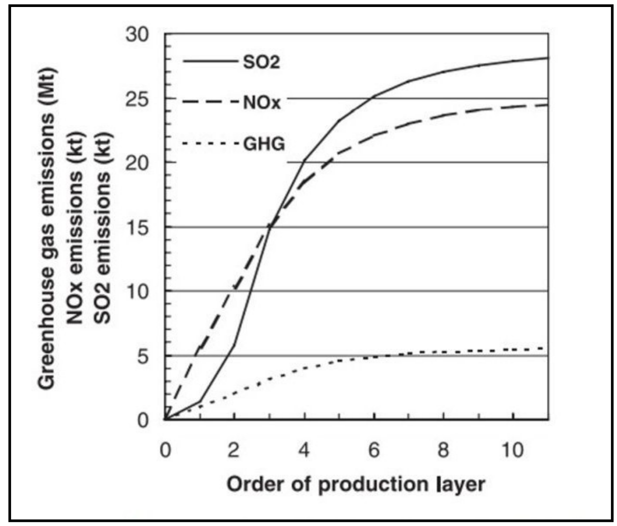

Figure 5, Emission of greenhouse gases, NO_x and SO_2 as a function of production layer order (PPK Environment and Infrastructure, 1997).

Table 2 shows the results with an indicator factor curve line against production layers.

Energy consumption	Water usage	Employment	Land disturbance	Emissions
Fuel + Energy: Construction Firms Energy: Construction Materials i.e., iron, steel	On-site: Cleaning and site-specific operations. Indirect: Water used in the delivery of electricity and construction material i.e., cooling water in manufacturing plants.	Direct; employment in service industries including technical, trade, and management.	Direct; Acquisition of privately owned land Indirect: Vacation of land for vegetation. Tertiary: land disturbed to produce timber material for construction.	Indirect: Production and the use of non-ferrous metals (Resilient to corrosion).

Table 2, The results against production layers.

As seen in many of the cases discussed above and in addition to direct effects, the development of new infrastructure causes indirect environmental pressure through elements such as the consumption of goods and services, and their successive activities which involve numerous ‘producing’ industries. This is explained by the nature of the process of industrial interdependence that flows in an infinitely upstream direction, cause and effect. In the case of constructing transportation infrastructure, not only are the direct environment pressures assessed as the impact on vegetation, wildlife, and the surrounding environments, but also the land occupied by producing the materials within the projects, by factories that produce the materials, to even the mining operation providing the raw materials i.e., iron ore for the steel factories and so on.

4.3 Discussion

For civil infrastructure projects, EIA is utilized as a better planning instrument for evaluating and predicting the likelihood of environmental impacts. Moreover, it is prudent for key policies to be implemented to enhance EIA and EIS strategies. For civil infrastructure projects, EIA incorporates parameters such as physical, cultural, biological, economic, and social factors. The International Origination for Standardization (ISO) 14011:1996 describes the general guidelines and principal steps for auditing environmental management systems. This includes general requirements, planning, environmental policy, implementation & operation, checking, and corrective action, and management review.

Furthermore, within the selected case studies, some of the indirect effects of several indicator variables, such as employment and land disturbance have been articulated and measured. However, as it can be imagined, not all variables are included in the EISs, and this was also the case with each of the projects (Sydney Metro and Sydney Second airport projects). There are three main reasons why such exclusion occurs. Firstly, the relevant data corresponding to the variables is not available, secondly, the effects are synergistic, which means that if for some reason two or more indicators are overlapping in a combination of developments, the impact can have correlations, resulting in the overall impact weight being lesser than the overall, or that the effects are nor quantifiable to necessary proportions. As mentioned in the data sources, the effects of flora and fauna, hazards, and risk have not been calculated. Conducting tests and yielding results can be futile as it may prove difficult to understand most variables in the sense that the environmental knowledge is limited, for example, biological effects are highly elastic and difficult to predict. For all the above-mentioned reasons, presently a static EIA approach is being implemented as these counter marginal changes and forecasting. Nonetheless, in terms of EIA for transport infrastructure, specific sustainability goals need to be measured, which carefully consider the specific operation and execution policies. This is represented in Figure 6.

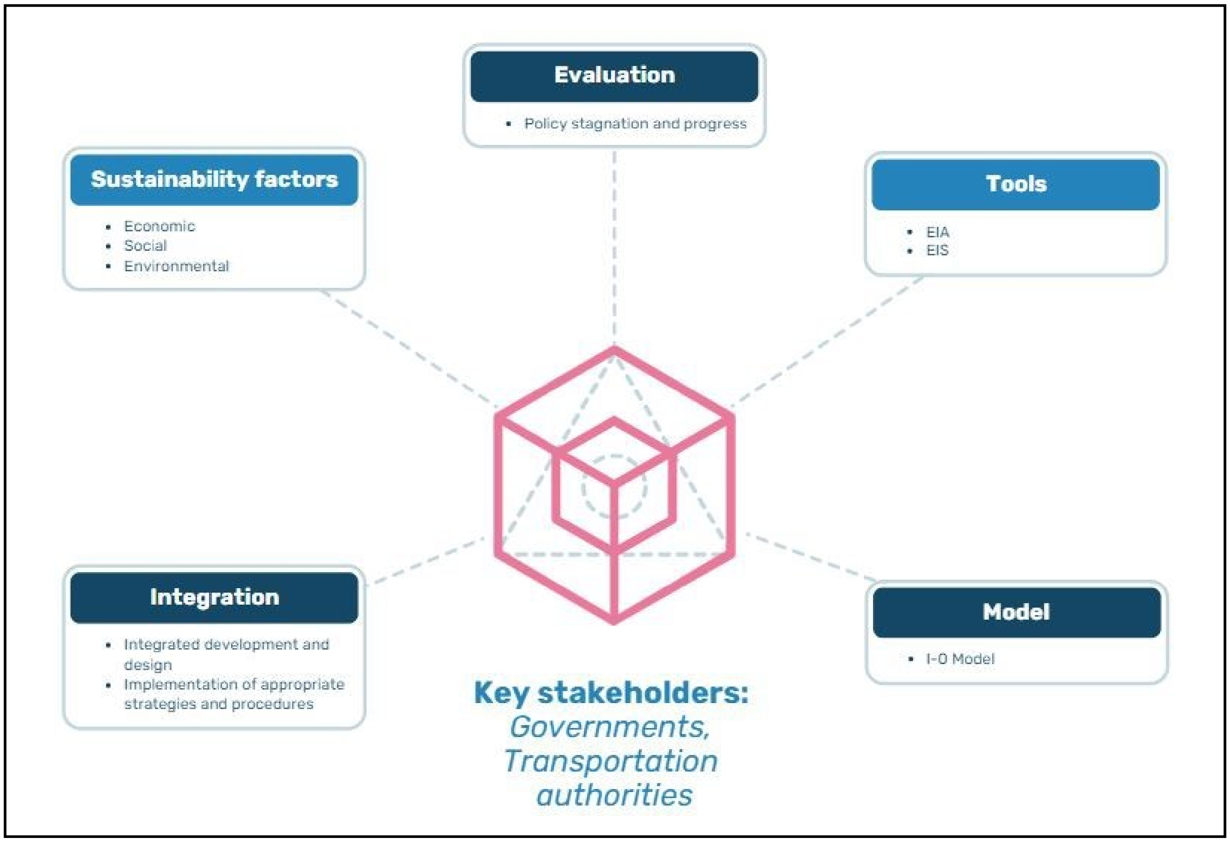

Figure 6, EIA and EIS policy framework for transport infrastructure.

Various implications covered in Figure 3, demonstrate the severity and impact effects have on the built environment and ecosystems. Large-scale projects and developments undertake necessary assessments to counter this problem; one attempt is also known as implementing an environmental impact assessment, thus providing an environmental impact statement. During this research, it has been noticed that to better enhance the EIA and to effectively calculate various indicator variables, a hybrid approach to the method known as an input-output analysis needs to be adopted. Knowing that a feasible cost breakdown is usually available within projects, it can be concluded that is it plausible to add an I-O model into an existing environmental impact statement to obtain results not only for onsite effects but also for off-site effects. Moreover, some of the benefits of implementing a hybrid input-output analysis can (1) significantly improve the completeness of any conventional EIS for a range of quantifiable indicators, (2) improve the ability to rank alternative options, and (3) provide a valuable overview of indirect impacts to be used for streamlining the EIA audit. For these reasons, input-output techniques could be incorporated as optional elements into EIA standards.

The I-O model has been enhanced to incorporate environmental elements. It is commonly known that the I-O model estimates three types of impacts which are indirect, direct, and induced, also known as initial (primary), secondary and tertiary impacts, respectively. Instances of the three impact types are: Construction of a transport infrastructure consists of requirements such as the amount of cement and steel as direct inputs (primary), suppliers that hire laborers to deliver the goods (secondary), and the outcome of those workers purchasing goods and services in return (tertiary). In the case studies for this research, the Sydney metro and similar projects such as the Sydney second airport can derive both economic and environmental indicators such as employment, land disturbance, energy, and water use. These indicators vindicate the total indicator intensities, which is the amount required to produce and deliver, extracted from both indirect and direct impact contributions, a value unit of a particular product or service.

5.0 Conclusion and recommendations

Investigating the environmental implications for both short and long terms is central for civil infrastructure projects. The ever complexity arises when the key stakeholders of such projects need to effectively encompass EIA and EIS for better policies and improved strategies. As tools, EIA and EIS will provide paramount information to better develop civil infrastructure projects and align with sustainability factors. In supporting such a synopsis, this paper proposed an I-O model (input-output analysis). This paper undertook a careful analysis and compared various environmental implications of construction activities. This then leads to the belief that indirect environmental effects are not being effectively incorporated into the initial assessment of both short-term and long-term effects. Moreover, it was found that the traditional EIA lacks coherent assessment and auditing for complex civil infrastructure projects. As previously mentioned, traditional EIA has trivial flaws, which have been the subject of negative consciousness. This is due to EIA's relatively narrow, spatial, and unpredictable scope. To further expand on the environmental impacts and effects, this research was able to determine that indirect environmental bearings within civil infrastructure projects are not being fully considered.

Moreover, the mentioned studies in this paper can influence altering the EIA application, since many of the complex civil infrastructure projects are unique. This includes unique deliverables and complicated constraints such as difficult geographical conditions and environment. Subsequently, better policies and legislation need to be developed and applied. This improvement can subsequently lead to better alignment of EIS with key project indicators and improve the ability to rank project alternatives and options. Overall, such an outcome can assist the key stakeholders of complex civil infrastructure projects to better plan for such projects. This in turn can lead to incorporating the proposed I-O model as the basis of EIA optimization.

Limitations of Research

Regarding the analysis of the Sydney second airport and similar large-scale projects, the assessment would be challenging since each project will produce different outcomes one way or another, due to its geological characteristics, surrounding environment, location, and climate, the culture of the inhabitants, language barriers and so forth. These are some of the issues encountered in different civil infrastructure projects with the addition of management and decision-making alterations, due to different government legislation, regulation, and laws. Although visibly it may seem all civil infrastructure projects are the same, the process of the I-O model can be different due to different frameworks.

Recommendations

It is noted that to obtain better results in input-output analysis, the auditing of consumables of commodities and the relationship between variables must provide a wider scope of data. Key stakeholders such as governments need to incorporate an innovative environmental assessment approach when undertaking environmental analysis for complex civil infrastructure projects. This allows for impact analysis by presupposing the existence of a causal model and systematic analysis of factors based on the input-output model. In terms of future research, it is recommended that the proposed EIA and EIS policy framework developed in this research be tested on similar transport infrastructure. Doing so, can better evaluate this framework and optimize its sequencing and processes.

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