Research Article

Social Impact Assessment of Construction Related to an Infrastructure Development Project in Karachi

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Abstract: An integrated social, environmental, economic, and statistical analysis is conducted of Karachi's construction sector in an analyzed case study and survey. The methodology involves the identification and ranking of adverse impacts and quantification of social costs based on well-known analytical models. The results have implications for the Environmental Impact Assessment (EIA) process improvement within Pakistan's construction sector. Knowledge of social ranking helps decrease adverse social and cultural effects and it can result in improvement of the EIA framework. It has been found that the vehicle operation cost covers 67% of the total social costs and the total social costs are 68% of the total cost of project. This amount is currently not considered by the professionals in the initial stages of the project and can lead to saving for society, if considered. This type of analysis can prove to be a new dimension of research for academics as well as for the professionals related to construction industry.

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Introduction

The growing interest of neighboring countries in institutionalizing construction activities has created an opportunity of fast track development in Pakistan in the form of China-Pakistan Economic Corridor (CPEC) project. As a result, foreign investment has generated a number of infrastructure development projects. Infrastructure projects can be monitored using project management techniques leading to the success of any project. PMBOK (Project Management Body of Knowledge) is a standard which aims to address project management issues to enhance productivity. It has divided project lifecycle into five process groups, namely, initiation, planning, execution, monitoring and controlling, and closing. Based on PMI (Project Management Institute) framework, this work aims to perform cost management of social factors using qualitative stakeholder analysis.

EIA is a planning tool which is used to evaluate environmental factors during the initiation phase of a project (McDonald and Brown, 1995). The

EIA not only covers the biophysical aspects of the environment, it also covers the socio-economic and cultural aspects of the subjects under assessment. It is used to identify environmental hazards associated with a proposed project, and has a direct impact on the planning phase of projects. Civil infrastructures, such as road networks, rail network e.t.c. are a necessity to meet the development requirements of a city.

In Pakistan, Pakistan Environment Protection Agency (PEPA) is the federal body responsible for protecting the environment has made it compulsory for project proponents to prepare an Initial Environmental Examination (IEE). The Pakistan Environmental Protection Ordinance (1997) under section 12 of the ordinance, proposes an Initial Environmental Examination (IEE) or an EIA shall be filed with the agency prior to the start of the project construction. The regulations have defined the criteria for the requirement of IEE or EIA by dividing the development projects into two schedules based on industry, the nature of project and the scope the of project. An Environmental Management Plan (EMP) is one of the deliverables of EIA which is a detailed list of mitigation plans to address the adverse impacts. The constraint in implementing the EIA system in Pakistan is that the proponents of development projects consider EIA as a potential hurdle in the path of development. Due to this, they lack the required level of commitment to EIA. Non-participation of the public in the EIA of a public project has been studied in China (Chi et al., 2013).

Problem statement

In Pakistan the focus of EIA report lacks a quantifiable finding of potential hazards and developing mitigation plans. The public is only involved in the consultation process when the major decisions have already been made. Hence the need to take their study input focus on public projects to provide services and to raise the quality of life.

Justification of problem statement

The barriers to effective public participation are separated in two categories i.e. individual barriers and institutional barriers.

The social effects, the primary objective in conducting a feasibility study of a case study project is to determine whether or not there is a true return on investment. However, it is difficult to integrate social impacts using financial tools (Burdge, 2003). Hence, there is room for improvement in the study of environmental, social and cultural impacts of a project. Based on the above the scope of this paper is related to the following objectives:

- To qualitatively analyze and rank the impact of construction activities on stakeholders especially infrastructure users / dwellers.
- To evaluate social costs within the planning phase of public sector projects in a case study based in Southern Karachi.
- To propose changes to the existing framework of EIA in order to identify social impacts of construction activities at the initiation phase of project.

EIA of projects in Pakistan

PEPA protects the environment by constituting laws. The EIA was also found to be independent of the project planning process (Nadeem and Hameed, 2010). Given this fact, one can imagine how important it is to create awareness among government authorities to establish policies for the EIA system and to make efforts required to bring it up to the mark. Public involvement at an early stage of the EIA can lead to better identification of potential impacts and better implementation of mitigation plans (Nadeem and Fischer, 2011). Construction projects bring more socio-environmental changes than mere development. Many lives are affected if the piles of cement and dust are not managed properly and preemptive measures are not taken to ensure worker's and public safety before the project execution phase (Nauman et al., 2024). Competent risk assessment is vital to minimize pollution, work-related threats, and fatalities to construction workers and people living near the construction site (Giri et al., 2024). Otherwise, unexpected incidents can delay project execution and delays in schedule can lead to litigation issues resulting in the halting of works.

Individual barriers are due to illiteracy, as well as lack of knowledge about public projects and the EIA process, whereas the institutional barriers are deliberately put in place so as to decrease the extent of public involvement. Such barriers include the language barrier (English as the only medium of data transmission), limited access to information and lack of communication infrastructure, unequal opportunities to participate and lack of resources to organize public participation event. It is concluded

that two major factors play an important role in the non-participation of public in the EIA process. These include sense of security and *significance of participation*. With an authoritarian form of political structure, stakeholder (public) is often reluctant to participate and raise their voice against projects having adverse impacts on them. Similarly, the significance of the concerns raised by public is important. If the concerns are not addressed promptly, a perception can develop that makes the process useless. This perception can be removed by developing a transparent approval system and addressing the public concerns in the design and execution phase.

Social impact assessment (SIA) and EIA

During construction phase of such project's impacts are monitored and controlled for quality. The adverse impacts of infrastructure development projects include, but not limited to, health and safety issues, changes in travel patterns and reduced leisure opportunities. The environmental hazards are associated with the construction material, the noise produced by the construction equipment and generation of airborne dust. It is emphasized that social and cultural impacts of construction should be made part of development project planning in order to avoid the social and cultural adverse impact of projects as in (Burdge and Vanclay, 1996).

SIA is used to foresee the probable impact of development projects and to minimize these impacts by developing mitigation strategies. Burdge and Vanclay have identified that the stress resulting from development activities on the inhabitants living within the construction zone of a project is identified as the greatest of all (Burdge and Vanclay, 1996). Burgde (1990) has identified 26 variables to model social impacts in various planning stages (Burdge, 1990) and has divided these variables into five categories, namely, a. population impacts, b. community arrangements, c. conflicts between locals and newcomers, d. individual and family level impacts and e. community infrastructure needs. The variables that are studied here relate to the last two categories (d, e). The variables include, disruption of a daily life and movement patterns, disruption in social networks, perception of public health and safety, change in leisure opportunities, change in community infrastructure, land acquisition and disposal and effects in cultural, historical and archaeological resources. It has been proven that social assessment within EIA framework can help in identification of social impacts and evaluation of social damages associated with the project which will lead to better planning and monitoring of projects (Burdge and Vanclay, 1996; Rickson et al, 1990).

Sustainable development and EIA

Sustainable development is the use of current resources without having to face extinction in quantity for future uses. It is known that the EIA process can lead to sustainable development by the mitigation of adverse impacts of development projects (Zuhair and Kurian, 2016) and it is necessary to incorporate the concept of social sustainability into this framework (Valdes-Vasquez and Klotz, 2012).

The relationship between EIA in Pakistan and sustainable development has been studied as an instrument for sustainable development (Saeed et al., 2011). The authors have studied one of the development projects in Islamabad, the capital of Pakistan. It was undertaken to resolve the issue of traffic jams at this intersection. However, the proponent, Capital Developmental Authority (CDA) ignored to conduct an EIA for the project and subsequent submission of EIA report to PEPA. The construction work was stopped after action was taken by PEPA when it received complaints from the locals facing environmental problems. Public consultation for this project was also found to be very poor and unprofessional. General observations of the public were made a part of the report but it was not backed by technical analysis. The alarming aspect of the study is that there is no check and balance on the EIA process as a whole. This results in the suffering of public. To avoid such a situation, the authors have calculated sub-indices of EIA to calculate the EIA Implementation Index (EIAI). The EIAI was found to be 0.57, which gives the ratio of the implementation of the EIA, and the authors have declared this to be reasonable but should be improved to achieve 0.8. However, sub-indices like the Public Participation and Consultation Index (PPCI) were found to be as low as 0.29. The index of 0.29 of PPCI shows that there is very low public consultation in EIAs conducted in our country. This ultimately leads to adverse social impacts on the society. To summarize, the importance of studying the social impact of construction activities on the society has been justified.

Case study

A traffic improvement project at A.T. Naqvi

roundabout and Park Tower intersection was completed in May 2015. The project suffered a number of setbacks due to litigation. The construction of this project was started in March, 2014 and was supposed to be completed by July, 2014. However, the project was put on hold in April, 2015 on environmental grounds as per orders of Sindh High Court for the protection of a cultural heritage sites, namely, Mahadev Mandir and Jahangir Kothari Parade. The proponent (Karachi Metropolitan Corporation) was asked to submit the EIA report before the construction work could resume. According to the EIA report of the project, which was submitted in June, 2014, the IEE for the project was submitted and approved by Sindh Environmental Protection Agency, SEPA (Environmental Management Consultants, 2014). The project falls in the Schedule-II of PEPA Regulations (2000) for which an EIA submittal is required before approval of project. The Sindh High Court ordered to stop the construction work based on this clause. However, stay in the construction work has resulted in the grievances of the local community, namely, temporary and permanent loss of businesses, noise pollution due to round the clock construction activities and unattended open excavation for underpass. Based on the above, it can be concluded that general public is one of the stakeholders of public development projects such as infrastructure development projects. Stakeholder consultation in EIA plays an important role in determining hazards and developing mitigation plans. Public hearing of EIA is mandatory before the approval of the project. This needs to be conducted at least 30 days after the EIA report is available for public review. In a similar study, (Nadeem et al., 2016) analyzed the collected data to check for the extent of community involvement in development of an Environment Management Plan (EMP) (Nadeem and Hameed, 2010). The study reveals that the reply to comments in public hearings is not substantial enough to result in revision of EMP.

Concept of social costs

Quantification of social costs in monetary terms will enable professionals to better understand the social impact of a construction project (Surahyo and El-Diraby, 2009). However, the scope of this research is limited to public projects. The primary reason to limit the research is the fact that exposure of the society to public construction activities is much greater. Furthermore, government is itself a stakeholder in such projects ensuring quality and ensuring repeatability. The study will thus have a greater impact. The study can be further extended to encompass private projects as well.

An alternate study estimating social cost based on awareness about climate change accumulation for climate policy targets reveals a non-stationary distribution (Tol, 2023). Yu and Lo (2005) have studied the concept of social costs and have formulated a Construction Social Cost (COSCO) model for the quantification of social costs (Yu and Lo, 2005). According to authors, the given model presents a conservative value of the construction associated social costs. The formulation is a simplified model and efficiency directly depends on the duration of construction projects. Gilchrist and Allouche (2004) have described impact assessment as a process that can identify potential impacts of construction, evaluate the costs associated with it and to develop a mitigation plan to decrease the intensity of the impact (Gilchrist and Allouche, 2004). This process is divided into three steps, (i) identification of impacts, (ii) evaluation of costs associated with these impacts and (iii) development of a mitigation plan. The authors have quantified the social costs in order to give a fair idea of construction related losses and implications for society. The valuation of social costs is important in developing countries such as Pakistan where projects are usually suspended or delayed due to various reasons.

Matthews et al. (2014) have extended the study of (Gilchrist and Allouche, 2004) for the quantification of social costs of any project. The authors have studied the open cut methods and trenchless methods for the laying of utility pipelines. They have compared both methods by evaluating the social costs associated with each method of construction and presented methods to calculate eight different types of social costs. These methods are developed based on the two case studies done by the authors. However, according to the authors, more case studies are needed to be conducted in order to gain confidence in the calculation methods. These methods shall be used in this thesis to evaluate the social costs of the case studies undertaken.

A traffic impact assessment report is appended with the EIA report by National Management Consultants (NMC) for the justification of the project which forecasts future demand, models and tests possible

solutions to encounter the traffic congestion issue. According to this report the existing infrastructure is not sufficient to carry the future traffic demand. The v/c (volume/capacity) for the existing highway network is greater than 1. This justifies that the existing road network needs to be upgraded in order to carry the forecasted traffic. This also indicates that the construction of the upgrade will be crucial. This is based on the fact that the traffic shall have to be diverted in order to carry out the construction works. An efficient diversion plan which can control the flow of the traffic is required to avoid traffic congestions.

Materials and Methods

An online questionnaire is used to conduct the survey. 58 subjects were questioned based on a survey in order to identify the severity and the frequency of these impacts. These impacts are then ranked based on the severity using Relative Importance Index (RII). The Frequency Index (FI) is also calculated and the impacts are also ranked based on frequency of occurrence. The level of agreement among stakeholders is calculated based on the survey results by calculating the Spearman's Rank Correlation factor. These techniques are widely adopted in the construction industry for the ranking of factors and to evaluate the degree of agreement among stakeholders. The social costs that are associated with the project are also calculated, where possible estimated, and compared with the actual cost of the project.

This endeavor is undertaken to identify what went wrong in the planning of the projects under study, whether the feasibility studies, the environmental, social and economic assessments were conducted or not and if there are any loopholes in the approval process of the project. The recommendations are made based on the research which shall be beneficial to the organizations performing EIAs and to the Planning Commission of Pakistan which is 217 responsible for planning future reforms of the country.

Relative importance index (RII) and frequency index (FI)

RII is a tool which is used for ranking parameters. This tool can be used to rank the reasons of delay of construction projects (Megha and Rajiv, 2013). Some researchers have used the same tool for the ranking of causes of construction delays in Saudi Arabia, UAE, Malaysia and Turkey, respectively (Assaf and Al-Hejji, 2006; Faridi and El-Sayegh, 2006; Sambasivan and Soon, 2007; Gunduz et al., 2012). The RII of each impact is calculated and the impacts are ranked based on the RII of each impact. The equation which shall be used to calculate RII is as follows:

$$RIIj = \frac{\sum_{i=1}^{N} W}{i} \quad \ldots (1)$$

Where; W_i is the weightage given by respondent "i" to the given impact "j", A is the highest weight; N is the total number of respondents.

Table 1 shows the impacts that is being ranked in this research. The authors have also suggested the use of a check for the accuracy of the data (Megha and Rajiv, 2013).

Table 1: *List of adverse impacts.*

S.	Adverse impact
1	Disruption of daily life and movement patterns
2	Impact on public health and safety
3	Change in leisure opportunities
4	Change in community infrastructure
5	Impacts of land acquisition and disposal
6	Damage to historical/cultural heritage
7	Loss of business opportunities

Spearman's rank correlation factor is calculated in order to determine the level of agreement between the stakeholders. It shall be calculated by using the following equation:

$$r_s = 1 - \frac{6\sum_{i=1}^{n}}{n^3 - n} \quad \ldots (2)$$

Where; d_i is the difference between the ranks; n is the number of impacts; In addition to the RII and Frequency indices shall also be calculated which will determine the frequency of the occurrence of the impacts. The following equation will be used to calculate the frequency index:

$$F.I_j(\%) = \left(\sum_{i=1}^{5} a_i n/N\right) \times \quad \ldots (3)$$

The weighted adverse impact. The frequency index shall be compared with the relative importance index and inference will 241 be derived from the results. The ranking of the impacts will give us the perception of the public regarding the adverse impacts of the

construction activities on the society. This shall be backed by the quantification of the social costs. Quantification of the social costs will enable us to compare the public perception of the severity of the impacts with the actual cost borne by the society.

Evaluation of social costs

The methodology used to accomplish this task is taken from the research done by (Matthews et al., 2014). Here, the values are explored locally and adapted to compare to existing models in the literature. The social costs have been divided into eight categories by the authors which are as follows:

Travel delay cost: The delay cost related to travel will show the total social cost of a project throughout its duration incurred by the public. The method is adopted by Matthews et al. (Year) and the equation derived by the authors are given below:

$$DC_t = VT \times N_v \times ITT \times D_h \quad \ldots(4)$$

Where; DC_t is the delay costs of traffic (PKR); VT is the value of time (PKR/hr), and is assumed to be based on the median salary of an occupant in Karachi i.e PKR 50,000 or PKR 284/hr. N_v, number of vehicles [vehicles/h], is taken from the EIA report of the project under study which has been calculated by using Highway Capacity Manual (Special Report 209, Transportation Research Board). The road between A.T. Naqvi roundabout and Bilawal roundabout in Karachi can be classified as major arterial, sub urban road with a vehicle capacity of 10,623 vehicles/hr. Shahrah-e-Firdousi, another road, has been divided into two segments for the purpose of analysis in the report. Segment one is defined from Bilawal Chowrangi to Park Towers and has a v/c of 0.56, segment two is defined from Park Towers to A. T. Naqvi Chowrangi and has a v/c of 0.23. Average value is considered for calculations here i.e. 0.395. The volume of the traffic based on 268 v/c and the capacity of the road is therefore 4,196 vehicles/hr. ITT is the increased travel time [h/vehicle]; the estimation is done based on the increase in travel distance due to detours. The traffic diversion plan and distance of 271 the original route and the alternate route are shown in Figures 3, 4 and 5, respectively. The increase in distance comes out to be 1.67 km. For an average speed of 60 kmph, the increase in travel time is computed to be 0.0278 hours/vehicle or 1.67 274 minutes/vehicle. D_h is the project duration [h]; project started in March 2014 and was completed in May 2015. The duration is 426 days or 10,224 hours.

Vehicle operation cost: Construction work on roads often results in the closure of existing roads. A temporary diversion is made as an alternative of the closed route (in length: 2.57 km) which is 280 usually longer than the original route. This results in consumption of extra fuel. Diversion plan is included in the EMP which is a part of the EIA report. In order to estimate the social cost, the amount of traffic has to be estimated along with the 283 average consumption of fuel and maintenance expenses of the vehicles. This cost can be computed as the operating cost of vehicles by using the following equation:

$$VOC = ITD \times OCA \times N_v \times D_h \quad \ldots(5)$$

Where; VOC is the vehicle operating cost (PKR), ITD is the increased travel distance (km) and is estimated by using the Google Earth computer application. This application enables users to calculate the distance by defining the path on the map. The diversion plan of the project under study is appended with the EIA report and is shown in Figure 1. The distance of the original path and the alternate path are shown in Figures 2 and 3. The increase in

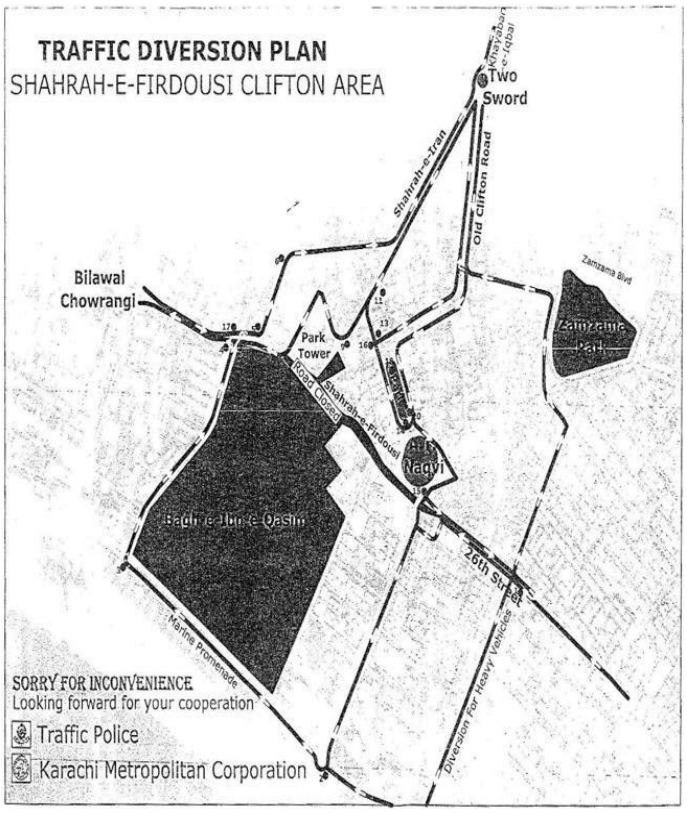

Figure 1: *Traffic diversion plan (Environmental Management Consultants, 2014).*

Figure 2: *Original route and distance of the flow of traffic before construction.*

Figure 3: *Detour distance during construction phase.*

travel distance is estimated to be 1.67 km. OCA is the operating cost allowance (PKR/vehicle km) and can be estimated easily by anyone who drives a car. The average consumption of petrol is around 10 km per litre for cars. Since most of the traffic comprises of cars in this route, therefore, for the purposes of simplification we shall consider the average values of cars. During the duration of the project, the price of petrol has varied between PKR. 84 and PKR. 108 per 298 liters. We are considering an average of PKR. 96 per liter for calculation. The maintenance of vehicles is generally implemented after running of 5,000 km, resulting in an average cost of around PKR. 3,500. The combined average operating cost of the vehicles comes out to be PKR. 10.3/km.

Decreased road surface cost: The existing road network adjacent to the construction zone is used as access to the site. Heavy machinery used the roads causing wear and tear and leading to reduced life. This required an early maintenance of the road which can be considered as a social cost. This cost shall be calculated for the partial closure of roads. In our case study, the complete road was closed and no traffic was flowing on this section of road. Therefore, the calculation of decreased road surface value shall not be applicable.

Loss of business revenue: Road closures have an adverse impact on the businesses in the vicinity as well. The public avoids traveling to shops where access is limited due to surrounding construction due to traffic congestions. The loss of business revenue from nearby shops in a construction zone results in social costs which is as follows:

$$LBR = IF \times TW \times D \quad ...(6)$$

Where; LBR is the lost business revenue (PKR), IF is the impact factor which can be considered as the percentage of the decrease in total revenue. In the vicinity of the project under study, prominent landmarks are Park Tower shopping mall, South City Hospital and a Cricket Ground. Park Tower shopping mall is located at the end of the road. Informal interviews were conducted with the staff at the shops located in the mall as well as with the staff of the National Bank Cricket Ground. As per the EIA report, the businesses faced around 70% decrease in revenue generation during the construction phase. The interviews and also resulted in more or less the same figure. However, most of the staff of the mall have been replaced. Most of the shopkeepers said that the sales decreased by approximately 50% during the construction phase. We shall use a value of 60% which is between 50%-70%. TW is the turnover per week (PKR/week) which is highly dependent on the nature of the business. The units in the Park Tower shopping mall consist of shops of garments, perfumes, footwear, jewelery, watches and restaurants. Informal interviews were conducted to determine the average turnover of the stores in the mall. The garment shops have reported an average weekly turnover of around PKR. 300,000. The restaurants receive around 30 customers per day with a weekly turnover of around PKR. 175,000. We shall take the average value of PKR. 225,000.

Loss of parking revenues: Loss of parking revenues occurs when the access to the parking space is reduced or the parking space is itself reduced. The erection of barriers around a construction site results in limiting access to a parking lot. A parking space, designated for the visitors of the Abdullah Shah Ghazi Shrine is located adjacent to the shrine. The access to the parking space was completely blocked during the construction of the project, rendering the parking space useless. The estimated capacity of the parking space is 50 vehicles. The loss of parking revenues under the current scenario can be calculated by the following equations:

$$LPR = TF \times FOT \times D_d \quad ...(7)$$

Where; LPR is the lost parking revenue. TF is the rate which is PKR. 20 per ticket. FOT is the frequency of ticketing (tickets/day). Informal interview with the staff managing the parking space have concluded that there are around 50-100 vehicles that use the parking space whereas on Thursday, the frequency rises to more than 200. An average value of 90 is assumed for the purpose of calculation.

Cost of dust control: Additional cleaning of windows is required for the buildings adjacent to the construction zone due to the airborne dust and material debris. This additional cost of cleaning can be considered as a part of the social cost due to construction activities. In the vicinity of the construction project under study, Park Tower Mall is the only visible buildings to be affected by dust. The cost of dust can be estimated as follows:

$$CDC = 2 \times L_b \times H_b \times W \times CF \times CC \quad ...(8)$$

This equation is modified to cater to the local factors. This modified equation is as follows:

$$CDC = L_b \times H_b \times W \times CF \times CC \times FOO \quad ...(9)$$

Where; CDC is the cost of dust control (PKR). L_b is the length of the building is measured by using the Google Earth tool as shown in Figure 4, and it comes out to be 146 m. H_b is the height of the building (m). The building is of ground plus two stories and the height of the building is assumed to be 16m. W is the share of windows (%) which is estimated to be 60%. CF is the correlation factor which can be considered as the increase in the frequency of the cleaning activity. The mall staff were of the opinion that the cleaning activity was carried out fortnightly before the construction whereas, during the initial days of construction, the frequency was doubled when the excavation works were at peak. We are assuming a factor of 0.5 i.e., 50% increase in the cleaning of windows, for the purpose of calculation. The equation shall be modified to relate the frequency of occurrence with the cost of cleaning. The duration of the project is 60 weeks. With a 371 fortnightly occurrence of cleaning, the estimated frequency will be 30. CC is the cost of cleaning (PKR/m^2), the estimated cleaning cost is obtained by the market surveys i.e. by contacting different service providers, and was found to be PKR. 375 per square meter. FOO is the frequency of occurrence.

Figure 4: *Satellite image of Park Towers shopping mall showing the affected part of the building by dust.*

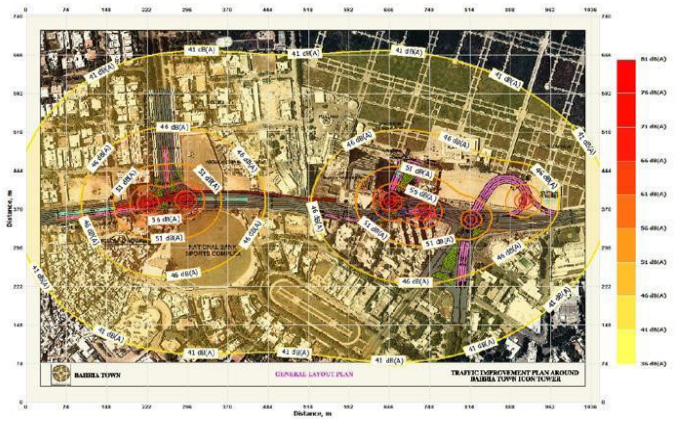

Figure 5: *Noise propagation model during construction for the case study (Environmental Management Consultants, 2014).*

Noise pollution cost: Construction activities are noisy due to the heavy equipment involved. The increase in the noise level results in adverse impact on the public in the form of physical and mental health issues as well

as behavioral changes. It is difficult to transform this impact in monetary terms. It is best computed with the help of fines issued by the municipal authority. The EIA report of the project has tabulated that National Environment Quality Standards (NEQS) for noise and compared the actual measured level of noise at the construction site. The noise propagation model presented in the report suggests that impart of noise pollution is limited to the microenvironment. Figure 5 shows the noise propagation model presented in the EIA report. Therefore, there are no adverse impacts related to noise pollution on the project under study.

Safety cost: Construction activities have potential hazards associated with it. These affect not only the construction workers onsite but also pedestrians in the vicinity of the construction site. The risk is even higher when excavation works are also part of construction works. This is true for the construction of flyovers and underpasses. Chapter 3 of the EIA report (Environmental Management Consultants, 2014) has outlined the estimated manpower requirement for the project. A simplified equation to compute the cost associated with the safety of workers is as follows:

$$CWR = IP \times PR \times M \times N_w \times WD \times D_d \quad \ldots (10)$$

Where; CWR is the cost of worker's risk (PKR). IP is the insurance premium (PKR/PKR of payroll) which usually varies from 1% to 2% of the gross income. PR is the payroll (PKR/hr), average income of Rs. 30,000/month is considered for the purpose of estimation. M is the multiplier for individual pain, suffering and wage loss. N_w is the number of workers working at the site is estimated to be 104 according to the report. WD is the working duration (hr/day) which is 8 hr/day. However, since a monthly salary is assumed, therefore this factor shall be neglected.

EIA framework

The existing framework of EIA is already under scrutiny. A number of papers have been published which have evaluated the existing framework and compared it with the international standard. Nadeem and Hameed (2010) have studied 18 projects in light of EIA, four of these projects were studied in greater depth and concerned employees of these four projects were interviewed (Nadeem and Hameed, 2010). The selected four projects were development projects of industrial sector and transportation infrastructure sector. All of the selected projects had an EIA report approved by the regulatory authorities. The collected data was analyzed under 17 internationally accepted parameters. The analysis established the status of legislation for EIA, the follow-up procedure of EMP, the degree of community involvement and the extent of learning.

The EIA report of the case study project is studied in depth and the gaps in the report are identified. The EIA report contains a detailed study of the environmental impacts of the proposed construction. Chapter 5 of the report deals with the social impacts of the construction. The assessment is limited to stakeholder analysis, which is done by conducting interviews of the nearby inhabitants. A quantitative analysis of the data is missing in the report which would have made the case stronger. The report also mentions the grievances of the public for not inviting the general public to the public hearing of the project's EIA report.

Although an invitation was published in the local newspaper, the rules of SEPA were not followed. Moreover, the published invitation was not catchy enough for the public to pay attention and therefore was ignored by most readers. The SOPs and recommendations to the local bodies shall be made after evaluating the existing EIA framework and reviewing the EIA of the case study. The analysis of the other two objectives will also complement the recommendations.

Results and Discussion

Relative Importance Index (RII), Frequency Index (FI), and Spearman's Rank Correlation factors are calculated after the data collection through a questionnaire. The number of respondents based on their category is given in Figure 6.

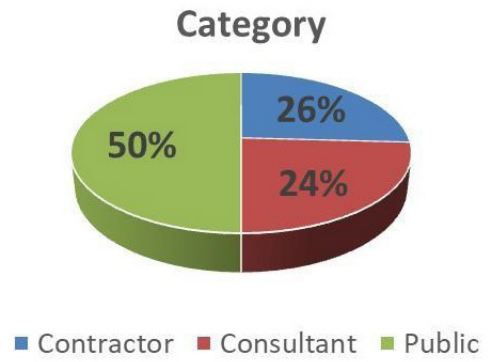

Figure 6: *Percentage of respondents based on category.*

In this analysis, the ranking of the adverse impacts of construction activities on society is done by calculating the RII of each impact. The ranking of the adverse impacts is based on the value of RII shown in Table 2. The ranking is modeled for each category of stakeholders and the coefficient of Spearman's Rank Correlation is further calculated in order to determine the level of agreement among stakeholders. The comparison of the ranking of all three stakeholders is summarised in Table 3.

Table 2: *Ranking of adverse impacts.*

Rank	Adverse impact	RII
1	Impact on public health and safety	0.714
2	Disruption of daily life and movement patterns	0.693
3	Change in community infrastructure	0.614
4	Loss of business opportunities	0.590
5	Damage to historical/cultural heritage	0.586
6	Change in leisure opportunities	0.583
7	Impacts of land acquisition and disposal	0.572
8	Relocation of friends and families	0.462

Table 3: *Comparison of ranking of adverse impacts by all stakeholders.*

Adverse impact	Contractor	Consultant	Public
Disruption of daily life and movement patterns	2	2	2
Relocation of friends and families	8	8	8
Impact on public health and safety	1	1	1
Change in leisure opportunities	7	5	4
Change in community infrastructure	4	3	3
Impacts of land acquisition and disposal	5	7	6
Damage to historical/cultural heritage	6	6	5
Loss of business opportunities	3	4	7

The ranking shows that impact on public health and safety is the most severe followed by disruption of daily life and movement patterns. A correlation factor of 0.881 is found between contractor and consultant which shows that there is a strong level of agreement between the two stakeholders. A correlation factor of 0.857 is found between consultant and public which also show that the perspectives of consultant and public have a good level of agreement. Similarly, the correlation factor 0.667 is found between contractors and public which also shows a fair level of agreement however, not as strong as the previous two relations. The primary difference between the perspectives of public and contractors lies in the rating of "Change in leisure opportunities" and "Loss of business opportunities". The public perspective regarding the former impact is strong with a ranking of 4 whereas the contractors have ranked it at 7. This may be due to the fact that contractors, who work and travel in the environment, do not hesitate in traveling through construction zones, whereas the public avoids the construction zones fearing unforeseen incidents. Similarly, the contractors have ranked the "Loss of business opportunities" at 3 whereas the public have ranked the impact at 7. It may be inferred from the results that usually small vendors are affected by the construction activities. The public, due to being unaware of such vendors in the vicinity of sites, does not consider it to be a severe impact. In general, there is a good level of agreement among the stakeholders.

The frequency index will determine the frequency of occurrence of each impact. The responses and the rankings are summarised in Table 4. The frequency index ranking is indicative of the frequency of occurrence of the impacts. The greater the frequency of occurrence the greater will be the impacts. A comparison of the rankings based on severity and frequency of occurrence reveals that both rankings are found to be very close to each other. It is worth noting that the most severe impacts are also the most frequently occurring. If proper planning and a mitigation plan is established, it will help in reducing the impacts to a great extent. Alternatively, if the impacts are ignored, it will aggravate the situation and the damage done by the impacts will increase.

Table 4: *Calculation of frequency index.*

Adverse impact	1	2	3	4	5	F.I (%)	Rank
Disruption of daily life and movement patterns	2	3	23	21	9	89.57	2
Relocation of friends and families	18	19	13	4	4	56.96	8
Impact on public health and safety	1	5	24	14	14	90.87	1
Change in leisure opportunities	2	15	21	15	5	78.26	4
Change in community							
Infrastructure impacts of land acquisition and	4	9	18	21	6	82.61	3
Disposal damage to historical/ cultural	5	10	22	16	5	78.26	5
Heritage	4	16	15	20	3	76.52	6
Loss of business opportunities	10	13	16	16	3	70.87	7

The social costs are calculated for the eight categories, defined in methodology, in order for traffic analysis report of the project and stated assumptions. Figure 7 shows the trend of the social costs. It is found that the vehicle operation cost is the most severe of all and amounts to 67% of the total social costs followed by the travel delay cost which amount to 31% of the total social costs. Rest of the impacts comprise of less than 2% of the total social costs. When comparing with the results of the research conducted by Matthews et al. (2014) it was found that the travel delay costs are the most severe and account for up to 55% of the total costs. The results are based on two case studies. The projects studied by the author also involves the complete closure of roads. This may be due to the fact that the average income of individuals is higher in other countries. Furthermore, the detour distance is also of prime importance in the calculation of the vehicle operation costs. The author has also compared the social cost with the direct contract cost of the project and found that the social cost was 44% of the total contract cost in one case and 63% in the other case. It has been reported that the project has cost up to 1.5 billion Pakistani rupees. The social costs calculated in this research are up to 68% of the total cost of the project. Figure 8 shows the comparison of the estimated social costs incurred and the social costs that would have been incurred with the implementation of mitigation plans. It is worth noting that the social costs would have been reduced to approximately half the estimated with the implementation of mitigation plans i.e., if halting of work was anticipated and the mitigation plan was devised.

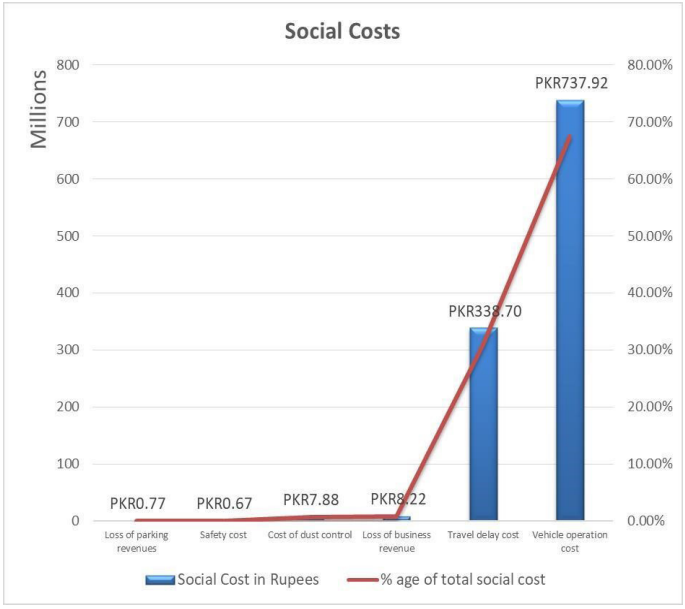

Figure 7: *The trend of social costs.*

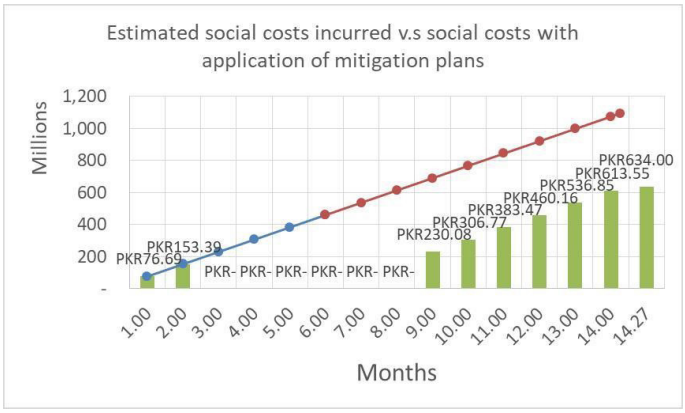

Figure 8: *Estimated social costs incurred vs social costs with application of mitigation plans.*

There is a different public perception of the social costs since the ranking of impacts reveals that the most severe impact is the impact on public health and safety. Nevertheless calculation of the social costs reveals that it covers a mere 0.1% of the total social costs. The methodology adopted for the calculation of safety costs involves the use of figures from health insurance and payroll. It is worth mentioning that assigning a monetary figure to human life is a difficult task. Many accidents are reported in Karachi resulting in daily deaths. According to research conducted in 1994, an estimated 972 deaths occurred in Karachi owing to traffic accidents and an estimated 11.2 deaths per 100,000 population (Razzak and Luby, 1998).

Accidents resulting in deaths have also been reported in the newspapers. These facts show that the impact on health and safety is surely a big issue which needs attention. In terms of the calculation of social costs, there is a requirement to further refine the methodology for the calculation of the social costs, especially the calculation of social costs related to public health and safety. Ingo Hansen have concluded in a research that the congestion costs of traffic are usually overestimated when compared to other social costs (Hansen, 2001). The author has also established a methodology for a more precise calculation of congestion costs. This requires a detailed amount of traffic information for implementation and would result in more accurate figures. Tang et al. (2004) has studied the investment in implementation of health and safety standards and compared it with the social costs incurred in terms of impacts on health and safety (Tang et al., 2004). Similar studies are required to be conducted in Pakistan as well. This will help in the establishment of standards in the health and safety policy.

Analysis of existing EIA framework

The existing EIA framework set by SEPA has been analysed to incorporate the SIA as a part of the framework. Figure 9 shows the flow of the framework and the steps involved in the EIA process. The encircled step in the whole process deals with the impact analysis. It broadly covers the environmental and social impacts.

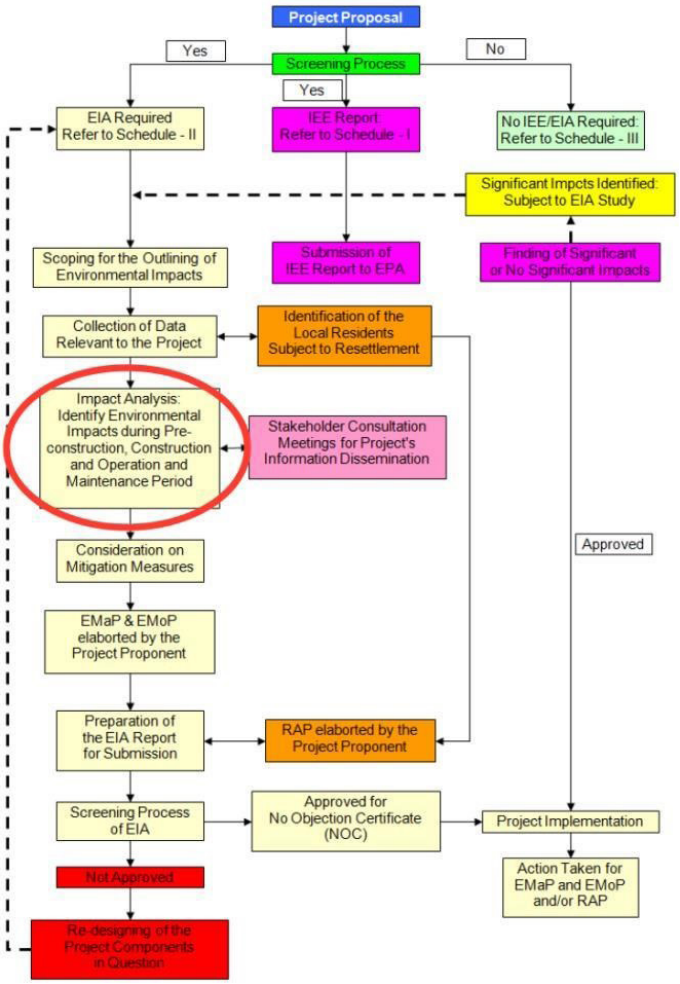

Figure 9: *EIA process (Environmental Management Consultants, 2014).*

SEPA is the provincial authority which is responsible for the implementation of the NEQS and monitoring of development projects from the environmental point of view. EIA reports are submitted to SEPA for approval after which, initiating the project officially. SEPA has set up a number of guidelines for the implementation of the NEQS to monitor the development projects. The guidelines cover clauses related to biophysical characteristics as well as the social and cultural characteristics of the environment. The IEE and EIA report of the project understudy has been reviewed to determine the level of implementation on the guidelines.

By studying the EIA report in light of the social impacts, it is found that the report has covered the adverse impacts qualitatively. Interviews had been conducted of the nearby inhabitants and business owners and their grievances have been recorded. The report highlights that temporary halting of construction has further intensified the impacts.

However, the extent of damage has not been calculated quantitatively. It has also been noted that the traffic management plan has not been reviewed and no recommendations are made to improve the plan.

Steps can be taken to improve the implementation of the existing framework. It is found that the environmental impacts are analysed quantitatively e.g., the ambient air quality, level of noise produced, temperature, protection of flora and fauna, protection of trees etc. This might be due to the fact the NEQS has established the standards against which the actual parameters can be compared. On the other hand, there are no standards established for the social impacts.

Nadeem et al. (2016) have studied the public participation in Pakistan and compared it with the status of public participation in developed countries (Nadeem et al., 2016). Based on their findings, they have proposed a number of recommendations that can elevate the status of public participation in Pakistan to make it more effective. The study of the author has revealed that the general perception that more public participation will result in better decision making does not apply in Pakistan. Ultimately it will result in poor participation process. On the other hand, public hearings involving educated experts, having the knowledge on the subject, can give a better insight into the potential impacts which can occur due to the project. The authors have concluded that conducting mediation workshops and advisory committee meetings will prove to be a better method for public participation by providing influencing role over the stakeholders.

The results of the questionnaire also suggest that most of the people are not interested in attending public hearings of projects. The reason behind this is reported lack of interest.

Conclusion and Recommendations

An accurate representation is proposed for calculation of social costs. An accurate methodology can be established in this context on Pakistan. This assists in standardization of EIA procedures.

- Efforts should be made to monitor implementation of existing EIA framework
- preferably using PMI framework. The incorporation of social costs at the feasibility stage will strengthen the purpose of EIA. At the stage of impacts identification, it is important that all aspects of the impacts shall be covered. A standard methodology can be established in this regard which will help in calculation. Standardization will also reduce the difficulty for the proponents and reduce the time required for review and approval. Furthermore, the encircled activity in the EIA process flowchart (refer to Figure 9) can be divided into two separate processes i.e. environmental impact assessment and social impact assessment.
- It is recommended to conduct the public participation within two stages; once with the technical officials, NGOs and environmentalists and other with the general public. This will help the proponents in evaluating impacts beforehand, and in this way the proponents shall be in a better position to defend the project and to answer the queries of the public.
- Due to the lack of interest on part of the public in participating in the EIA hearings, it is recommended that public awareness programs should be conducted. These will elaborate the importance of EIA and role of public in mitigation of adverse impacts.
- Midway halting of works or excessive delay in completion of works is a major cause of aggravation of the impacts. It is evident that the social costs are dependent on the duration of the project. Therefore, if the project is delayed, the suffering of the public will increase due to indirect adverse impacts of the construction activities. If such a situation occurs, efforts from all means shall be made to resolve the issues at stake and resume the works as early as possible.
- The evaluation of EMP is an important aspect in successfully and safely implementing a project. The EMP should incorporate the mitigation plans to cater for the delay in project and the associated impacts on the society. EMP shall be evaluated and revised, if required, during the construction phase. Efforts from all stakeholders should be made in order to implement the EMP of a project.
- It has been found that the impact on health and safety is the most severe of all. The health and safety policy shall be revisited and the implementation tools of the policy needs to be studied. Study of the social costs of health and safety and its comparison with safety investment needs to be studied to establish standards for the social costs related to health and safety issues. The need for multidisciplinary social costing for EIA is emphasized.

Author's Contribution

Muhammad Bilal Yasser: Conceptualization, writing - original draft

Muhammad Imran Majid: Conceptualization, data curation, formal analysis, funding acquisition, investigation, supervision, writing - review & editing

Conflict of interest

The authors have declared no conflict of interest.

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