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Evaluating the Environmental Impact Assessment of Road Rehabilitation Projects: Comparative Study of Pakistan and Vietnam

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Abstract: Roads are the backbone of any nation's economy and welfare. Construction, maintenance and improvement of roads result in significant exploitation of natural and physical resources. In order to alleviate this pressure from already depleting resources, conducting Environmental Impact Assessment (EIA) of new roads or their rehabilitation projects seems vital. The practice of such EIAs varies slightly in different countries. A comparison has been made between EIAs of Pakistan and Vietnam. This study is conducted to assess the impact of road development on the environment as well as associated practices and methods of steering EIA in these nations. Therefore, analysis of EIA processes with respect to screening, scoping, focus on environmental and social impacts, including the mitigation measures, has been carried out. Investigation reveals that problems in road development remain the same irrespective of the location of the project, but the magnitude of environmental issues varies in subject countries. Numerous mitigation measures are proposed but the effectiveness of these measures has not been evaluated. Post project evaluation is needed to assess the strength of these remedial measures.

Key words: Environmental impact assessment, Road, Highway rehabilitation, Social impact, Environmental monitoring.

INTRODUCTION

Roads are the strength of any nation and often portray a state's economic and physical condition/health. Motorized roads have not only boosted economies but also increased the quality of life, especially in developing countries (Kedir *et al*., 2016; Lacono and Levinson, 2016). Unfortunately, construction, repair, and restoration of roads also result in extensive environmental degradation at the same time (Glasson *et al*., 2012; Findlay and Bourdages, 2000). Inadequate planning and development of roads have adverse effects on natural-living, non-living and the human environment (UN-ESCAP, 2001), as demonstrated in Fig. 1.

Resultantly, Environmental Impact Assessment (EIA) became a go-to tool for analyzing and rating sustainability of a road development projects. The concept was first introduced in USA in the late 1960s and later on accepted by other developed countries. Although, environmental governance differs largely from region to region, the concept gained significant acceptance in the global north (Li, 2008. The legislation/ratification of EIA provides a legal footing and illustrates EIA processes for different kinds of projects (including road projects). Typical EIA consists of several steps, namely screening, scoping, reporting, public participation, review, decision making, and monitoring (Glasson *et al*., 2012).

Road projects have a long lifecycle and they have a significant influence on economy and accessibility of a given region or nation. That is the reason; they require a diverse and huge volume of data on social, economic, environmental, institutional, political and geographical aspects of proposed project location (Fan and Chan-Kang, 2005). Hence, multiple factors are needed to be studied for road projects, which can impact the environmental and social characteristics of the communities. Some of these aspects include contamination of soil, air pollution, water quality, excessive noise, poor drainage, endangerment of local flora and fauna, loss of livelihoods, displacement of population and structures, etc. These factors differ with the type and size of a road project. In the context of these aspects, road projects are categorized as new, existing, rural, urban and mixed. The type 'new' road

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projects focus on averting impacts, whereas 'existing' type of road projects focus on rehabilitation and mitigation of negative impacts (Hoban and Tsunokawa, 1997). Therefore, EIA process ought to be systematized in a way that it carries both interim and long-term impact assessment (of a complete lifetime) of the project. This requires the assimilation of the EIA process into the entire course of road development, starting from the conception of a road project to the planning stage, later operation, maintenance, monitoring, and evaluation of the project (UN-ESCAP, 2001). Various approaches have been advanced in developing countries (i.e., Pakistan and Vietnam) to conduct EIA. Many developing countries have established specific EIA guidelines for road projects (UN-ESCAP, 1998).

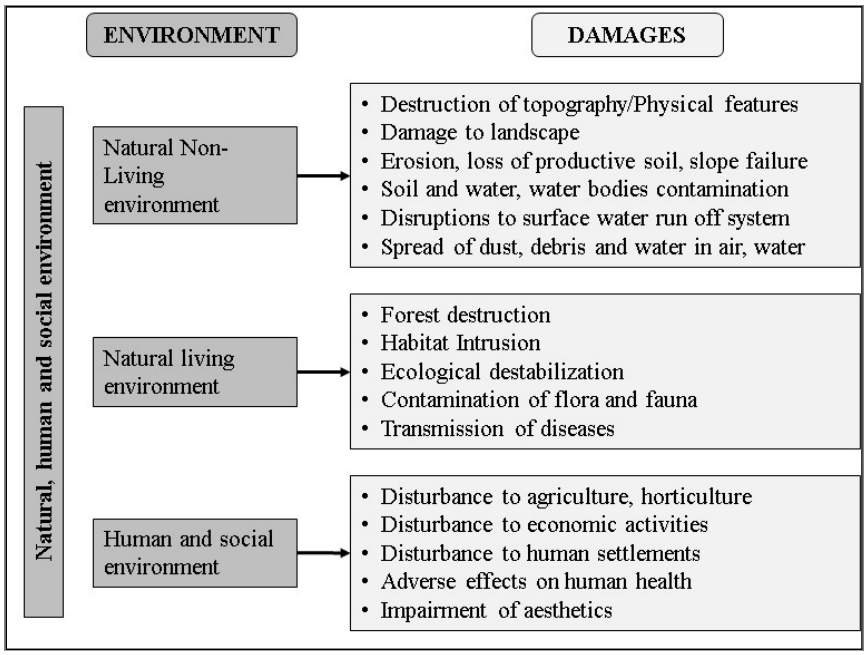

Fig. 1: Damages as a consequence of road development in different environmental contexts (UN-ESCAP, 2001).

EIA methods and guidelines differ slightly depending on the type of road project. Interestingly, a majority of the previous EIA assessment studies has analyzed the new road projects, and limited attention is paid on road rehabilitation projects. Therefore, it is necessary and critical to focus on EIAs of existing road projects. This study draws a comparison between two 'existing road' EIAs one from Pakistan and one from Vietnam. These case studies mainly focus on rehabilitation and mitigation of negative impacts. The process of EIA, used for the rehabilitation of national highways in both countries, is discussed in detail, especially the environmental and social impacts including the proposed mitigation measures, to draw both similarities and differences before declaring good and bad practices in them.

METHODOLOGY

The aim of this research is to critically analyze the EIA process of 'existing' road projects, to understand both the loopholes and imitable characteristics. The primary methodology adopted for this study is literature analysis. Existing literature and EIA reports of few selected projects were reviewed from Asian countries, like, Pakistan, India, Bangladesh and Vietnam. Six primary stages of EIA of road rehabilitation projects were identified and critically analyzed. Summary of comparative analysis is drawn (Table 1), showing different stages of EIA and methods/measures adopted.

Selection of study area

In order to make this comparison useful and justified for the readers, policy-makers, and academics; it is made sure that road projects selected are of similar scope. After reviewing the road rehabilitation projects of few Asian countries, Pakistan and Vietnam were considered for the detailed analysis as the EIA of 'existing' road was very similar in case of Pakistan, India and Bangladesh, hence, it might not lead to any interesting conclusion. EIA projects in Pakistan and Vietnam present similarities as well as differences in terms of organization structure, EIA process, and physical environmental conditions may provide vital information to guide EIA policies in both countries. Therefore, two highway rehabilitation projects, one from Pakistan (Pakistan Highway Rehabilitation Project) and the other from Vietnam (Rehabilitation and Improvement of Highway 20) are chosen to analyze different stages of the EIA process. A brief description of these case studies is provided in the following sections.

1) Pakistan Highway Rehabilitation Project (PHRP)

Pakistan is an important region in South Asia. It is facing severe environmental challenges owing to

industrialization, urban development, frequent floods, and infrastructure expansion. Consequently, in order to assuage the situation, Pakistan developed a legislative and regulatory framework for EIA in 1984, which was later amended in 1997, as Pakistan Environmental Protection Act (PEPA). It provided EIA processes with strong legal basis (Government of Pakistan, 1997), where public sector road projects are considered substantial in EIA processes (Nadeem *et al*., 2013). National highway (N5) accommodates around 80% of the urban population of Pakistan and connects the country with Afghanistan. According to National Highway Authority (NHA) of Pakistan, traffic volume will increase up to 180% by 2024 on highway N5 (NHA, 2003). Increasing road traffic has not been harmonized by the appropriate upgrading of highways and roads. Therefore, NHA initiated Pakistan Highway Rehabilitation Project (PHRP) in 2003 for N5 with funding from the World Bank. The scope of the project is far bigger than the definition of repair and rehabilitation of PEPA and costs over 200 million PKR. This justifies the incorporation of EIA in PHRP approval process (NHA, 2003). EIA was carried out by the government consultant. The project consists of the restoration of 226 km including construction of supplementary carriageways, earthworks, drainage provision, intersection remodeling and provision of public amenities at certain sections of N5 (Fig. 2A).

2) Rehabilitation and Improvement of Highway (RIH) 20, Vietnam

Vietnam is the eighth most populous country in Asia, located in south-east corner of the continent. Changing environmental conditions owing to the massive development projects necessitated the invocation of EIA, which was promulgated via Environmental Protection Law in 1993, which was amended in 2005 (Nam, 2010). National Highway 20 is the backbone of traffic in the Dong Nai province, which connects the province to three other economic centers especially Ho Chi Minh City. The road also links major recreational, cultural and political centers. Its continuous operation during several decades has degraded it badly, poses safety risks and a possible economic decline. According to the national government, traffic volume will increase by 200% by 2025, on the subject highway (Directorate of Roads Vietnam, 2011). As a consequence, its rehabilitation was started in 2011, by the Directorate of Roads, which is also a main investor in this rehabilitation project. The project studies the same components as PHRP. Different sections of 268 km length along RIH are proposed to be rehabilitated. The road rehabilitation project was of more than 50 km, so proper EIA was done by a consultant (Fig. 2B).

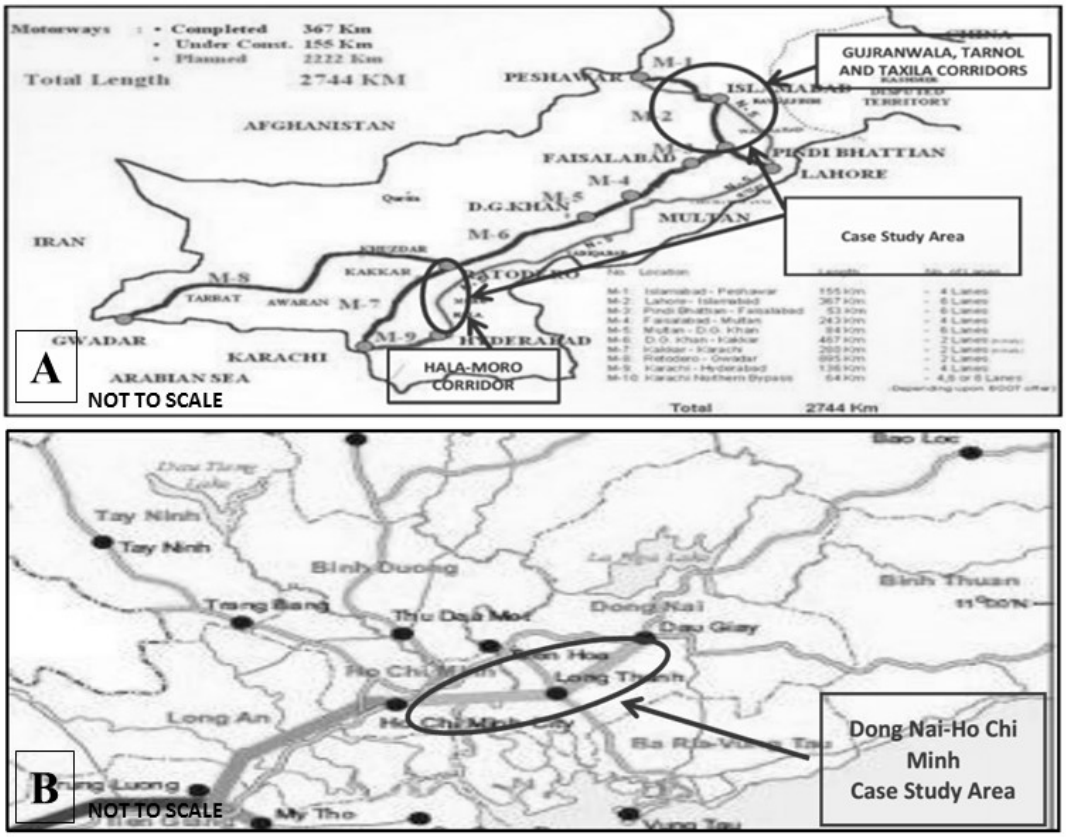

Fig. 2: (A) Sections of highway N5 selected for rehabilitation of road and to conduct EIA; (B) Section of highway NR 20 for rehabilitation and to conduct EIA.

COMPARATIVE ANALYSIS

Screening: Screening is a process, which indicates whether a project requires an EIA or not. The screening criteria differ in different countries based on monetary value of a project or volume of a project. According to Pakistan Environmental Protection Agency (Pak EPA) regulations, EIA is required for the road projects having a price tag of over 50 million PKR (1$ = 104 PKR on 21 August 2016) except repairing of existing metalled roads. An initial Environmental Examination (IEE) is required for the projects less than the cost of 50 million PKR (GoP, 2000). In Vietnam, the legislation requires EIA report for any road project greater than 50 km in length. It also contains the restoration and upgradation of road projects, details of which are stated in Decree 80 and 21 (Thu *et al*., 2010).

Scoping: According to EU Directive, scoping is a process of identifying the content and extent of the environmental information to be submitted to the competent authority under the EIA procedure (European Commission, 2001). It is considered as the most important process, as at this stage, baseline data regarding environmental parameters is collected parallel to the public participation data (Morrison-Saunders and Arts, 2012).

3) Baseline data

In PHRP, existing road condition was analyzed at first and different types of structures in right of way were indicated using maps. Shah *et al*. (2010) argued that baseline data in many developing countries, like Pakistan, regarding noise and air pollution, is not readily available. Therefore, data regarding environmental conditions, like air, noise, soil, climate and water quality, were collected. The data on air and noise was collected using different electronic instruments (computer models, like ADMS and sound level meters) at specific distances from the road. Different chemical tests were carried out in order to investigate PH, acidity, fertility of water and soil. Traffic and socio-economic investigations were performed to evaluate the baseline conditions. Moreover, data concerning location of game reserves, wildlife sanctuaries, forest, settlements as well as cultural and heritage sites were also collected and assessed.

In RIH, a detailed analysis of the existing environmental, social, physical and cultural aspects was also carried out. Data were analyzed with respect to different road sections considering water source, wetlands, soil type, mineral resources, each animal, insect and plant species, temperature, humidity, settlements, telecommunication, and electricity network. The quantitative baseline data for aforementioned aspects was already available and analyzed technically.

4) Participation

Public participation was carried out at scoping stage to ascertain potential affectees and vulnerable groups. Furthermore, *in situ* discussions were carried out to identify likely environmental and socio-economic effects that can arise during construction and operation of the project. The issues pointed out by this session were noise and air pollution, unavailability of vegetation, degradation of soil quality due to campsites, effects on employment, resettlement, women mobility due to non-local labour, unavailability of public amenities, dangerous curves and intersections and safety. Besides, locals were encouraged to participate in monitoring of the whole project. Public participation in RIH at this stage was not carried out. However, it was carried out after the completion of Environmental Impact Statement (EIS). The major issues raised by the public were those related to compensation and pollution generated during the construction phase of the project.

5) Alternatives

Several project alternatives, like rail, air and substitute surface routes, had been considered and analyzed. Benefits and shortcomings of each alternative has been evaluated with respect to its cost, value, and significance. Furthermore, the usage, revenue generation in past and tendency of people towards each alternative, as well as, government priorities were ascertained. On the other hand, data sources indicated that no project alternatives had been discussed for rehabilitation of highway 20 in Vietnam.

Impact assessment: Impact assessment includes both direct and indirect impacts of the project (Morris and Therivel, 2001). In PHRP, direct impacts include interruption of squatters on road right-of-way, removal of vegetation, and resettlement. Consumption of natural resources, vehicular and toxic emissions, as well as, noise and vibration, were the key indirect impacts (NHA, 2003). Situation related to impacts was alike in RIH Vietnam, particularly management of waste resulting from construction, removal of trees and plantation, power sourcing and camping were among the major problems. Hoban and Tsunokawa (1997) viewed that rehabilitation projects provided the opportunity to mitigate the existing environmental impacts.

6) Environmental impacts

In PHRP, impact matrices and overlay maps were used to assess the effects of each project activity on environmental and social aspects during construction and operational phases. The project could impact the land-use and natural resources due to the activities, like campsites, borrow pits and vehicle workshops, that could impact soil fertility due to waste generation from campsites and vehicles. Water resources might also be affected during construction and operation phase. Chemicals and fuels, used in construction, could contaminate groundwater and natural water channels. On the other hand, highway embankments could restrict the cross country-drainage during operation. It was analyzed that the project could

severely affect the air quality during construction and operation. Dust and emissions from construction machinery severely affect the air quality and depending on the wind speed, the nearby settlements could be affected. Dispersion model was used to forecast the magnitude of vehicular pollution (Nadeem *et al*., 2013). Gaussian Dispersion Model was utilized, which is commonly used throughout the world. The analysis suggested that PM, NOx and SOx concentrations would get worse in future. Moreover, the noise level was expected to rise in future and could affect the population within 50 meters from the edge of the highway. The project had a significant influence on the flora. It is estimated that 1200 mature trees would be cut down whereas no forest reserve is going to be affected by the project. Furthermore, no substantial impact on wildlife was assessed and no endangered species were found within the project area.

In RIH, the impacts were similar to PHRP but the impacts of project preparation phase had also been incorporated with other two phases. The project negatively impacts the environment by affecting air, surface and underground water, and soil sediment. The impact of noise and obstruction of transportation facilities, especially during the construction phase, is also significant. The land would be degraded due to the establishment of camp-sites on agricultural land. Construction and demolition activities produced dust and worsen the air quality, resulting in significant health impact on workers and residents. Waste water and dust would also impact the nearby crops as well as degrade the soils. Noise could disturb the settlements and human health in a 120 m radius. The terrestrial eco-system like insects, wildlife would be affected including more than 42000 trees of different ages (Directorate of Roads Vietnam, 2011). In operational phase, emissions from vehicles were expected to be increased from prescribed air quality standards. Forecast made using Sutton Dispersion Model indicated that the value of NOx would be increased from allowable limits within specified areas of 50m-80m. Besides, the noise level is expected to increase in future from the standard level of 70 db.

7) Social, cultural and physical impacts

Social and cultural impacts were an integral part of EIA, especially to maintain the sustainability of the process (Pope *et al*., 2004). In PHRP, there were safety concerns regarding the mobility of the people in the construction phase. Lack of bus bays and pedestrian bridges could increase the accidents. In operational phase, a concentration of commercial activities and squatters on the right-of-way of the road was considered a security threat. It was analyzed that hiring outside (Non-local) laborers could result in social discomfort and community disputes as well as a restriction on the mobility of women. Furthermore, impact on religious and cultural sites had been evaluated. Displacement and relocation of people from the project area were one of the major impacts of the project owing to the land acquisition for road widening. According to EIA report of the project, 468 structures including squatter assemblies needed to be relocated. Resettlement had a significant impact on livelihoods, social and physical assets (e.g., loosing social connection from the relatives, water and electricity connections). Moreover, assessment of impacts on areas of game reserves, recreational and heritage sites due to improved accessibility had been evaluated. All the issues and impacts of project acknowledged in scoping stage were also considered.

The main social impact in RIH project was resettlement of 64 households and rebuilding of infrastructure facilities, like telecommunication and electricity poles. According to an estimate, 1226 poles were to be relocated resulting in permanent disconnection of electric and telecom services from the area. The income of household engaged in food trading could be affected due to construction activities as dust would affect the food and reduce the corresponding commerce. Resettlement would affect the social contact and livelihoods. Increased road accidents and safety risk for workers, residents, and users was another impact of the project.

Mitigation measures: The purpose of mitigation measures was to find the improved methods of doing things, boost environmental and social welfare, cure adversarial effects and certify that outstanding impacts are within adequate levels (Sadler and McCabe, 2002). Hence, numerous measures had been considered during design, construction and operation phases of both the projects. An important part of PHRP was to engage people to voice their views on proposed measures.

8) Mitigation of environmental impacts

PHRP had delineated several measures to mitigate severe impacts on ecology. In addition, to reduce stress on land use, the project suggested the use of barren land with a high elevation for setting up camps and other facilities. If agricultural land is unavoidable, the top 30 cm of the plough layer would be stripped and stockpiled for redressing the land after completion of the project (NHA, 2003). Disposal sites have been identified for safe disposal of waste after treating it to mitigate the impact on soil and water. Numerous drainage channels had been planned to regulate the waste and storm water, as well as impervious liners for borrow pits to reduce stress on soil and groundwater. Soil erosion had been avoided by planting indigenous grasses and stone pitching. Quarry areas and asphalt plants planned to be located at least 500 m away from settlements, wildlife habitats and project camps, to abate the impact of dust emissions. Vegetation along the road, continuous air quality check, enforcement on vehicle maintenance as well as the use of cleaner fuels were proposed as mitigation measures to reduce strain on air quality in long-term. In case of noise pollution 10 feet high wall as a barrier would be erected on sensitive locations. Moreover, tree plantation program was initiated

during the project activities to compensate for the impacts on flora, which also helped in reducing noise pollution in addition to enhancing air quality and providing a better environment for the road users.

In RIH project, significant measures were adopted for the construction and operational phases. A top layer of soil was proposed to be removed before setting up campsites. Measures were taken for treating solid waste and wastewater before disposing off into drainage channels to keep them unpolluted. The significant handling of hazardous substances and its storage was carried out in special containers in order to reduce severe effects on soil and water. Moreover, proper drains were planned along the road and construction camps to drain wastewater and protect the soil. The dampening of an area during construction and demolition was proposed to reduce pollution due to dust. Additionally, the construction camps were suggested to be built at least 120 meters away from the residential area to avoid health and noise issues. Energy efficient cars were suggested to be employed to ensure the stability of air quality in long run. Further, restriction of any kind of construction was proposed in a 60 meter buffer. Vegetation was proposed after the completion of the project in place of damaged trees and the protection of wildlife was ensured by prohibiting hunting.

9) Mitigation of social impacts

Safety of user, residents and other stakeholders was an important concern for PHRP. Therefore, during the construction phase, roadside furniture, traffic control devices as well as traffic diversions and flow markings were considered. Traffic management plan, roadside public facilities, including first aid centers and awareness programs for the road users, were planned for the operational phase. Local labor was proposed to be hired to avoid any social discomfort. This initiative would not only provide employment to the local people but also could result in better connection with them. Standard safety measures specified by the International Labour Organization (ILO) had been proposed. Considering displacement, World Bank resettlement policy was adopted and affected people were relocated to the locations near the existing ones with all allied facilities. Moreover, compensations were arranged according to the Land Acquisition Act 1894, against the loss of private land and built-up properties.

In RIH project, cash compensations are proposed instead of permanent acquisition of land for road widening and provisional land procurement for campsites. Displaced residents had also been compensated with cash. The safety measures were assured particularly sign boards, markings, and emergency plans in case of any crisis or disaster.

Environmental Management Plan (EMP)

EMP defines all the actions for monitoring and evaluation of every phase of the project (Shah *et al*. (2010). An environmental monitoring plan was prepared and provided in the EIA of PHRP. EMP proposed several actions and organizational setup, including the responsibilities of various stakeholders involved in the project (Nadeem *et al*., 2013). Later, the affected people had been compensated and resettled before the initiation of the project. Independent consultants were also hired for environmental monitoring. Proper monitoring unit, called Project Management Unit (PMU), had been put in place for the RIH project. This unit monitored the implementation of environmental protection measures of the project. The responsibilities had been assigned to all the departments and personnel in different phases of the project.

Environmental Impact Statement (EIS)

EIS is one of the main elements in interpreting EIA policy into practice (Glasson *et al*., 2012. The quality of EIS also indicates the level of effectiveness of EIA (Nadeem and Hameed, 2006), as it represents the methods, procedures and key results of EIA process. The major features of EIS include the use of different maps, detailed description of legal aspects, impact matrices, qualitative analysis, explaining impact and mitigation together, etc. Though, in RIH, EIS is very technical based on the detailed quantitative information. Technical details, like formulas, the cross-section of road, etc., were a part of this report. The inclusion of comprehensive summary was strongly suggested through several legislations of EIA for EIS report.

RESULTS AND DISCUSSION

There are clear differences between the EIA processes of both countries, especially with respect to screening, social aspects, and EIS. The comparison of commonalities and differences are summarized in Table 1, according to six stages of EIA. In Pakistan, screening was done on monetary basis, while in Vietnam road length was the criteria. It is analyzed that screening principles can easily be manipulated by the project developers. The project limits can be intentionally reduced (e.g., 50 km length can be made 49 km, etc.) to avoid EIA. In PHRP, different environmental, social and cultural factors are discussed. Though, the details are less *vis-a-vis* RIH. Many environmental and other aspects in scoping have not been incorporated in road EIA of PHRP, e.g., animal and plant species, soil types, humidity, telecommunication, and electricity network. Project alternatives help to reduce the cost of the project. Involving community early on in the project reduces the conflicts as well as help project owners to take more informed decisions. However, in highway rehabilitation project of Vietnam, public participation and project alternatives have not been incorporated at the outset.

Analysis of various impacts and mitigation measures of the project suggest that effects in both the case studies are almost identical. Though,

methodology to deal with the issues is a bit different. The case study in Pakistan used impact matrices for EIA, whereas description based on numerical data was used with the specific focus on air quality and waste generation in Vietnam.

Dispersion models used in both case studies can easily be calculated using computer programs. PHRP had proposed to use barren land and removing rich soil layer (in case of agriculture area) in addition to cash compensation. On the contrary, RIH project gave compensations only. The dampening of an area was proposed to reduce the dust effect and health impacts, which were not considered in PHRP. Maintaining the air quality in the long run, PHRP project considered the government policies for cleaner fuels; alternative energy sources, etc., whereas RIH suggested the use of energy-efficient cars. PHRP suggested tree plantation during construction activities which can significantly reduce the air and noise pollution. RIH suggested tree plantation after the construction. The mitigation measures for protecting common and endangered species of plants, insects, and animals had not been considered by both case studies. In RIH, a restriction was imposed on development within 60-meter buffer, which resulted not only in safety from air and noise pollution but also from accidents. No such kind of enforcement was considered in PHRP. It indicates that people in Vietnam are more sensitive towards noise and air pollution than in Pakistan.

Table 1: Commonalities and differences in the EIA of road rehabilitation of Pakistan and Vietnam.

Stages	Indicators	PHRP, Pakistan	RIH, Vietnam
Stage 1	Screening	Monetary (50 million PKR or more)	Metric/Length (50Km or more)
Stage 2	Scoping	Baseline studies Data collected for studies Alternatives Public participation	Baseline studies Data already available
Stage 3	Social impacts	Safety, resettlement, cultural sites	Safety and population displacement
	Environmental impacts	Impact matrices and maps for analysis Less details on biotic and abiotic factors Impacts focus on operational and construction	Use of numeric information for analysis More details on biotic and abiotic factors Impacts on preparation, construction and operation phase is considered with special focus only on construction phase
	Air quality models	Gaussian model	Sutton model
	Noise level calculations	$Lp = Lx - 20\log\left(\frac{r}{rx}\right)$ dB	$L_2\ (dB) = L_2 - 20\log\left(\frac{r2}{r1}\right)^{1+a}$
	Standards	WHO standards for air quality and noise	Vietnam's own standard for air quality and noise levels
Stage 4	Social impact mitigation	Safety measures in operation phase Resettlement schemes and cash compensation	Centered on financial solution, i.e., compensation
	Environmental impacts mitigation	Major emphasis on selection of camp sites (on barren lands) Mitigation focus on operational and construction	Emphasis on treating and disposing waste generated during preparation and construction phase
Stage 5	EMP	Non-comprehensive Responsibilities are not well defined Third party (NGOs etc.) are involved in monitoring of certain aspects	Comprehensive Responsibilities are well defined Public departments are involved in monitoring
Stage 6	EIS	Qualitative/Theoretical Impacts and mitigation measures are discussed side by side in same section	Quantitative/Tabular data Impacts and mitigation measures are discussed in separate chapter

Source: Own construct.

PHRP had considered the impact on cultural and heritage sites as well as on game reserves which were missing in other case study but at the same time, no mitigation measure was proposed for these aspects. The community was involved at the stage of mitigation by PHRP. Affected people of the community were employed in the process, which enhanced the skills of local people and provided them with livelihoods. RIH used compensation as a tool for land acquisition, crop damage and resettlement of people whereas in Pakistan resettlement along with necessary infrastructure was provided to the displaced people. Nadeem *et al*. (2013) are of the view that cost for mitigation measures had estimated and included in the budget of PHRP, which is not a part of EIA report so often and it was also overlooked in RIH.

EMP was an important part of EIA which ensured the execution of whole EIA process. It had been examined that in PHRP, EMP was given but it was not as comprehensive as in RIH. Responsibilities had not been assigned to any department except for the resettlements, which is dispensed to Non-Governmental Organization (NGO). It is explored that

EMP did only the monitoring of implementation of mitigation measures. Nonetheless, it was important to access the effectiveness of these measures in order to evaluate positive or negative impacts (van der Grift *et al*., 2013). Post evaluation of remedial measures had not been carried out both in PHRP and RIH and implies the weaknesses in exercising of EIA regulations.

EIS of both road rehabilitation projects has presented contrasting features, which are a strength of one project but a weakness of the other. It was examined that PHRP lacks several technical aspects in its EIA and emphasizes only on qualitative aspects. In contrast, RIH report was completely established on quantitative information, like tables, formulas, etc., which was difficult to understand for non-technical readers. To assess impacts, PHRP focused on methods mapping and impact matrices, whereas, no such thing had been observed in RIH, which was totally based on qualitative and numerical parameters.

CONCLUSION

Roads are vital means of logistics, especially, in the global south. The development of road network brings economic prosperity, but it also compromises on the local environment. Certainly, the environment not only comprises flora and fauna but also social dimensions particularly, impact on public and their opinion on road projects. A comparison of environmental impacts of road development, specifically road rehabilitation in Pakistan and Vietnam, is made by critically analyzing case studies from each country.

In Pakistan, EIA is based on monetary value of proposed road project, whereas in Vietnam, road length is a primary indicator. The hiring of private consultants in both countries highlights the grave inability (insufficient staff, lack of instruments for air and quality check, lack of professional expertise, etc.) of public departments to carry out EIA by themselves. However, in order to remove the bias, the third parties are hired for conducting the assessment. Nevertheless, government institutions should have the capacity to critically evaluate such reports to make the whole process more efficient. The absence of baseline data in Pakistan increased the cost and timeframe of the project. It is also seen that the problems remain the same whatever be the location of the project, but the magnitude of environmental issues varied, e.g., effect on flora, noise and air pollution and human displacement. None of the project under consideration had environmental problems which could jeopardize the whole project and it seemed that each problem has compensatory measure if not a proper solution, indicating the room for more research and validation of impacts of similar projects on the environment.

The major problem was discovered and a feasible solution was also presented; some of them were implemented too. Nevertheless, no data was acquired regarding the effectiveness of the remedial measures. It is believed that to assess and validate the effectiveness of the remedial measure a comprehensive post-project data acquisition is necessary and then an impact factor must be evaluated by comparison of this data to the baseline data.

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REFERENCES

Directorate of Roads Vietnam, 2011. Report of environment impact assessment project for rehabilitation and improvement of national highway No. 20 - section from Dong Nai to Lam Dong province. Environmental Assessment. Directorate of Roads. Ho Chi Minh City (BT20). https://www.miga.org/documents/BT20_EIA.pdf.

European Commission, 2001. Guidance on EIA-scoping. Luxembourg: European Commission. http://ec.europa.eu/environment/archives/eia/eia-guidelines/g-scoping-full-text.pdf.

Fan, S. and C. Chan-Kang, 2005. Road development, economic growth, and poverty reduction in China. International Food Policy Research Institute, p. 52.

Findlay, C.S. and J. Bourdages, 2000. Response time of wetland biodiversity to road construction on adjacent lands. Conserv. Biol., 14(1): 86–94.

Glasson, J., R. Therivel and A. Chadwick, 2012. Introduction to Environmental Impact Assessment [electronic resource]. Fourth Edition: Routledge.

GoP (Government of Pakistan), 2000. Gazette Notification No. SRO 339(1) 2000. http://environment.gov.pk/act-rules/IEE-EIA-REG.pdf.

GoP (Government of Pakistan), 1997. Pakistan environmental protection act. http://apps.who.int/fctc/reporting/Pakistan_annex2_environmental_protection_act1997.pdf.

Hoban, C. and K. Tsunokawa (Eds.), 1997. Roads and the Environment: a handbook. Washington, D.C: World Bank (World Bank technical paper No. 376).

Kedir, M., E. Schmidt and A. Waqas, 2016. Pakistan's changing demography: Urbanization and peri-urban transformation over time. PSSP Working Paper 39. Washington, DC. International Food Policy Research Institute (IFPRI). http://ebrary.ifpri.org/cdm/ref/collection/p15738coll2/id/130266.

Lacono, M. and D. Levinson, 2016. Mutual causality in road network growth and economic development. Transp. Policy, 45: 209–217.

Li, J.C., 2008. Environmental impact assessments in developing countries: An opportunity for greater environmental security. Working Paper. Foundation for Environmental Security and Sustainability. Falls Church, VA (Working Paper No. 4). http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.562.7417&rep=rep1&type=pdf.

Morris, P. and R. Therivel, 2001. Methods of environmental impact assessment. Spon Press.

Morrison-Saunders, A. and J. Arts (Editors), 2012. Assessing impact: Handbook of EIA and SEA follow-up. Earthscan, p. 360

Nadeem, O., R. Hameed, S. Haydar and A. Naeem, 2013. Institutional set-up for environmental governance through EIA in Pakistan: The case of Public Sector Development Projects. Pak. J. Sci., 65(3): 357–364.

Nadeem, O. and R. Hameed, 2006. A critical review of the adequacy of EIA reports – Evidence from Pakistan. World Acad. Sci. Eng. Technol., 23: 64-70.

Nam, L.H., 2010. Development of EIA system in Viet Nam 1993-2010. Geneva, Switzerland. http://www.unece.org/fileadmin/DAM/env/eia/documents/WG14_MOS3_nov2010/Presentation_EIA_in_VietNam.pdf.

NHA (National Highway Authority), 2003. Rehabilitation and maintenance projects, environmental impact assessment. National Highway Authority, Islamabad. (E752, Vol. 3). http://documents.worldbank.org/curated/en/628501468286780810/pdf/multi0page.pdf

Pope, J., D. Annandale and A. Morrison-Saunders, 2004. Conceptualising sustainability assessment. Environ. Impact Assess. Rev., 24(6): 595–616.

Sadler, B. and M. McCabe (Editors), 2002. Environmental impact assessment training resource manual (2nd Ed.). Geneva, Switzerland: UNEP Division of Technology, Industry and Economics. Economics and Trade Branch. http://www.unep.ch/etb/publication/EIAman/IntroManual.pdf.

Shah, A., S. Khan, M.H. Shah, R. Khan and I. Jan, 2010. Environmental impact assessment (EIA) of infrastructure development projects in developing countries. OIDA Int. J. Sust. Dev., 1(4): 47–54.

Thu, N.T.A., T.G. Doan and JDM Environmental Consulting, 2010. Harmonization of EIA in support of the Ha Noi core statement on aid effectiveness: Development of guidelines for environmental management plan and public consultation in EIA. http://www.adb.org/Documents/Reports/Vietnam/EIA-Harmonization-Report-2009.pdf?p=vietrans

United Nations-Economic; Social Commission for Asia and the Pacific UN-ESCAP, 2001. Multistage environmental and social impact assessment of road projects: Guidelines for a comprehensive process. New York, NY: United Nations Publications.

United Nations-Economic; Social Commission for Asia and the Pacific (UN-ESCAP), 1998. A draft report on the review of the status of environmental/social impact assessment of road infrastructure projects in the ESCAP region. Bangkok: United Nations Publications.

van der Grift, E.A., R. van der Ree, L. Fahrig, S. Findlay, J. Houlahan, J.A.G. Jaeger, N. Klar, L.F. Madriñan and L. Olson, 2013 Evaluating the effectiveness of road mitigation measures. Biodivers. Conserv., 22(2): 425-448.