EIA Effectiveness in Road Construction Projects: A Stakeholder-centric Approach in Tanzania

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Abstract

This study examined how effective EIA has been in mitigating the negative impacts of road construction projects in Tanzania. Specifically, the study aimed to identify the weaknesses and strengths of EIA processes, and analyse the factors influencing the community members' perceptions towards EIA process participation. A cross-sectional design was employed. Purposive random sampling was used to select districts and villages while simple random sampling was used to select household heads. Some villages, (Hwazi, Kwedikabu, Kwamsisi, Songambele, and Murusi) were selected for data collection and 204 households were randomly sampled. Semi-structured questionnaires were used to collect data from selected respondents. Descriptive statistical analysis, ordinal logistic regression, and Likert scale analysis were used to analyse quantitative data. Qualitative data were analysed using content analysis. Results showed several strengths of the EIA process in road construction projects which included, ensuring environmental concerns are addressed, provision of opportunities for public participation, encouraging sustainable practices, and increasing awareness on EIA matters. The weaknesses

included limited public participation, insufficient enforcement of EIA recommendations, and lack of consideration of community needs. Moreover, age, gender, education level, and perception of the community members were statistically significant variables that affected community members perception towards EIA process participation ($p<0.05$). The study revealed that stakeholders thought that the ability of the EIA process to guarantee that environmental concerns are taken seriously was its main strength. The main weakness identified was community members' limited public engagement meetings. The study showed that community members' perceptions of EIA process participation were significantly influenced by age, perception, sex, and educational level. The study recommends that regulatory bodies, project proponents, and local authorities should collaborate to strengthen community engagement in the EIA process. EIA practitioners and regulatory authorities should actively promote inclusivity in stakeholder participation. Also, government agencies, NGOs, and educational institutions should collaborate to implement education and awareness programmes.

Keywords: Participatory assessment, Socio-environmental impact, Project sustainability

Introduction

Environmental impact assessment (EIA) effectiveness is very crucial for road construction projects and other developmental projects. The EIA established over the past 40 years has been in line with rising environmental concerns (Kosamu et al., 2013). According to Kabera and Mutavu (2023), impact assessment has been dominated by the issue of effectiveness in environmental impact assessments (EIA) because it is essential for ensuring that development projects are sustainable and do not cause significant harm to the environment.

According to Chang et al. (2018), in industrialized countries, the efficiency of EIA in road projects is continuously reviewed and enhanced. The legislative frameworks in these countries are well-established and

require the inclusion of EIA in the planning and approval stages of infrastructure projects, particularly those involving roads. In these situations, the EIA process is distinguished by its thoroughness, taking into account a wide range of environmental concerns including air and water quality, biodiversity, noise, and socioeconomic repercussions. To guarantee that community concerns are addressed and that decision-making is transparent, public participation is always stressed (Salcito et al., 2014).

Effective EIAs go beyond assessment and include robust mechanisms for post-approval monitoring and compliance, to ensure the implementation of proposed mitigation measures (Kalima, 2011). Addressing cumulative effects in areas where several projects are underway at once and including climate change issues in the evaluation process are among the difficulties faced. In order to increase precision and predictability, ongoing efforts concentrate on emerging technologies like geographic information systems (GIS) and modelling tools. Furthermore, several countries are embracing adaptive management strategies, which enable the change of mitigation measures in response to continuing monitoring and input. The commitment to coordinating infrastructure development with sustainability objectives and reducing environmental impacts while promoting community well-being is reflected in the changing landscape of EIA effectiveness in road projects.

According to Kabir and Khan (2020), a special set of difficulties and circumstances has a profound impact on the efficiency of environmental impact assessment (EIA) in road construction in emerging African nations. Furthermore, depth and effectiveness of the EIA process are impacted by resource restrictions, both financial and in terms of competence (Marara et al., 2011). These countries confront a strong need for infrastructural development because of their rapid urbanization and population growth, which increases the need to move projects along quickly. Numerous African nations' diverse biomes and delicate ecosystems demand special consideration of any potential environmental effects (Glaeser & Henderson, 2017).

Kolhoff, Runhaar and Driessen (2009) have made the case that EIAs are successful in developed nations but have limited success in underdeveloped nations, which led them to the conclusion that the country-specific context has a stronger impact on the effectiveness of the

EIA system. Even though this is an interesting argument, it makes the assumption that EIAs are more effective in developed nations and less effective in those in the west. In order for EIA to be effective in road projects in emerging African nations, political will, capacity building, community participation, international backing, and adaptation to local contexts emerge as critical variables. In order to improve the overall effectiveness of the EIA process in these settings, it is crucial to strengthen regulatory frameworks, develop local capability, and promote international cooperation (Betey & Essel, 2013).

Furthermore, it is crucial to remember that EIAs are carried out in particular sociological and cultural contexts, which will affect the results and efficacy of the assessments (Kirkman et al., 2021). Thus, to ensure that this process is successful, it is important to consider institutional capability, norms, and culture, in addition to procedures. In their broadest definition, norms and culture would encompass, in addition to professional ethics for environmental assessments, the understanding and respect of the rule of law, protocol, and the relationships and values that underpin these systems.

The success of Environmental Impact Assessment (EIA), which includes community involvement and full participation, tends to have a beneficial impact on the sustainability of the road projects. EIA is essentially a technique for environmental management to ensure that impacts from development are minimized, avoided, or addressed. It is used to identify potential implications that could be predicted from development initiatives.

The EIA process for road construction is crucial as it aids the identification of potential environmental effects, assures adherence to environmental laws, fosters public engagement, and supports sustainable development (Mushtaq et al., 2020). Environmental Impact Assessment (EIA) is being widely practiced in Tanzania as a planning tool that identifies the potential impacts associated with development projects (Mwanga, 2022). However, the EIA process in Tanzania is not effective due to inadequate EIA laws (Mwanga, 2022), inadequate or lack of accountability in enforcing the Environmental Management Act 191, stakeholders' inadequate knowledge regarding environmental protection, and corruption and abuse of power (Sosovele, 2011). Also, regarding road construction projects, a World Bank report noted that most road

construction projects in Tanzania have led to an increase in the rate of early pregnancies among female secondary school students. Despite the significance of EIA which has evolved in recent years, the effectiveness of the EIA process has not gained much attention as most studies have been directed towards its practices and procedures (Fischer et al., 2014; Noble and Nwanekezie, 2017). Therefore, this study aimed to assess the effectiveness of EIA for road construction projects in Tanzania.

The results from this study will inform policy makers and other stakeholders of road construction projects on ways to minimize the weaknesses of EIA in road construction projects, thus making it effective for the environment and making it sustainable. Furthermore, it offers knowledge that can be applied to create more inclusive and interactive methods of decision-making in infrastructure development initiatives.

Research Methodology

Study sites

This study was conducted in Hwazi, Murusi, and Songambele villages in Kasulu District and Kwedikabu and Kwamsisi villages in Handeni District. Handeni District is located at longitude 38° East and latitude 5°30' South while Buhigwe is located at latitude -4.45088 and longitude 29.91369, or 04° 27′ 03.16″ S and 29° 54′ 49.28″ East. The two districts were selected because of the ongoing road construction projects. In Handeni District, the construction of the Makurunge – Saadani – Pangani – Road was ongoing and in Kasulu, the Kasulu – Manyovu road project was ongoing

Research design and approach

The cross-sectional design was deemed appropriate since, according to Matthews and Ross (2010), it allows for the collection of data on past and present experiences as well as the identification of any connections or cause-and-effect interactions between variables. This method was also selected because it can accomplish the study's objectives, is easy to implement, and is quick, economical, and time-efficient.

Sampling techniques and sample size

In this study, sampling techniques based on probability and non-probability were applied. Purposive sampling was employed to choose villages where road works were already underway. To choose the heads of the households from the studied villages, simple random sampling was employed. For this study, 204 households from the two districts were chosen as participants. Three villages, Songambele, Hwazi, and Murusi, were chosen from Kasulu District, whereas just two, Kwedikabu and Kwamsisi, were sampled in Handeni District. Using Cochran's (1977) sample size formula for continuous data, the sample size was established. The formula is as follows:

$$n = \frac{z^2 * (s^2)}{d^2}$$

where:

n = sample size,

z = value for the selected alpha of 0.25 in each tail = 1.96 which corresponds to 95% confidence interval,

s = estimate of standard deviation in the population which is 0.5, and

d = acceptable margin error (i.e., 0.05) of the mean or proportion being (Cochran, 1977, cited by Bartlett *et al*., 2001).

The formula is for an infinite population and gives a sample size of 384, i.e.:

$$\frac{(1.9^2) * (0.5^2)}{(0.25^2)}$$

Cochran's (1977) correction formula for changing the sample size for smaller populations was further utilized to adjust the 384 sample, taking into account the population size, since both the population from which the sample was drawn, i.e., 384, and the population size for the villages (435) were finite. The formula is:

$$n = \frac{sample\ size\ for\ any\ population\ size\ i.e.\ 384}{\frac{(1 + sample\ size\ for\ any\ population\ size)}{population\ size}}$$

Therefore, the sample size of 204 was obtained as follows:

$$n = \frac{384}{\left[1 + \frac{}{\left(384/435\right)}\right]} = \frac{384}{1 + 0.88275862} = 204$$

where:

n = Sample size

Data collection

Primary data were collected from the randomly selected respondents using a semi-structured questionnaire that included both close-ended and open-ended questions. The purpose of the questions was to learn more about the variables influencing the community's opinion of attending EIA meetings. Information was also acquired from interviews with key informants. In total, five key informant interviews (KIIs) were carried out with village executive officials. Data collection was done using the KIIs checklists. To ensure familiarity and clarity, the data collection tools were pre-tested in the study area before the actual data collection. This served to assure the validity and reliability of the data acquired. The gathered data was not included in the study's final analysis.

Data analysis

The Statistical Package for the Social Sciences (SPSS) version 20 was used to evaluate the quantitative data obtained from the questionnaire. From this, both descriptive (multiple responses) and summary statistics were obtained. Additionally, the degree of community perception of the EIA process was ascertained by Likert scale analysis, and the factors influencing community opinion of the EIA process were examined using ordinal logistic regression. Additionally, content analysis was used to examine the qualitative data. Measurements of the various variables applied in the study were carried out as shown in Table 1.

Ordinal logistic regression was used to determine the association between the factors affecting community participation (perceptions, family size, gender, education level, years living in the area were used as

independent variables) and whether the perception is low, high or moderate as dependent variable (ordinal). The p-value of (≥0.05) was used to determine whether differences or relationships between variables were statistically significant.

Table 1: Measurement of variables (categorization and definitions of explanatory factors)

Variable	Expected outcome	Measurement
Perception	(±)	Measured on nominal scale
Family size	(±)	Measured on ratio scale
Education level	(±)	Measured on nominal scale
Age	(±)	Measured on ratio scale
Gender/sex	(±)	Measured on nominal scale
Years of living	(+)	Measured in ratio scale

Results and Discussion

Socio-economic characteristics

The demographic and socio-economic characteristics of the respondents are presented in Table 2.

Table 2: Socio-economic characteristics

Characteristic		Kasulu	Handeni
Categorical			
Sex	Male	87(69)	59(75.6)
	Female	39(31)	19(24.4)
Marital status	Married	123(97.6)	77(98.7)
	Not married	3(2.4)	1(1.3)
Educational level	Informal education	118(93.7)	76(97.4)
	Primary education	8(6.3)	2(2.6)
	Secondary education	0(0)	0(0)

Characteristic		Kasulu	Handeni
	Higher education	0(0)	0(0)
	University	0(0)	0(0)
Occupation	Employed	6(4.8)	2(2.6)
	Unemployed	85(67.5)	58(74.4)
	Self employed	35(27.8)	18(23.1)
Continuous		Mean	Mean
Family size		4	8
Income		19 942.24	65 474.36
Time living in the area		10	7

*Number in brackets are percentages

Strength of EIA in road construction projects in Tanzania, based on feedback obtained from different stakeholders affected by road construction activities

The strengths of the EIA process in Handeni and Kasulu districts, Tanzania as indicated by stakeholders are presented in Table 3. The major strength of the EIA process is ensuring that environmental concerns are addressed (26.3%). This implies recognition of the process's effectiveness in fulfilling its primary objective. Stakeholders likely perceive EIA as a valuable tool for systematically identifying, evaluating, and mitigating potential environmental impacts associated with proposed projects. This acknowledgment suggests that the EIA process has been successful in bringing attention to environmental considerations and ensuring that steps are taken to minimize adverse effects on the environment. The results are in line with the study by Ulibarri, Scott and Perez-Figueroa (2019) who reported that most of the stakeholders of EIA process/meetings are aware and expect that different environmental concerns are to be addressed during the EIA process. The environmental concerns which most of the stakeholders expect to be addressed by the EIA process include noise pollution, air pollution, waste management practices, and social and economic impacts.

Another strength of the EIA process is that it increased awareness of EIA matters (25.8%). This result implies that whenever there are EIA meetings, awareness on EIA matters seems to be a major issue in that area. This is proved in a statement made by one on the respondents:

> *"During the road construction EIA meetings, all the community members who attended the meetings were educated by the road construction officials on the importance of EIA activities, the way they will be compensated if the road passes through their areas such as houses. This highly increases awareness on the environmental matters and the way different pollutions can be tackled"*

The results from the strength of EIA in road construction projects in Tanzania, based on feedback obtained from different stakeholders affected by road construction activities, are consistent with the results from Famiyeh et al. (2017) who reported that education training during the EIA process of road construction projects highly increases awareness of the environmental concerns which becomes the burning issue in the area. Furthermore, proper education training on the importance of EIA in road construction is of vital importance to the nearby community members (Marzouk et al., 2017).

Table 3: Strengths of EIA in road construction projects in Tanzania, based on feedback obtained from different stakeholders affected by road construction activities

Strengths	Frequency	Percentage (%)
Ensuring environmental concerns are addressed	164	26.30
Providing opportunities for public participation	152	24.40
Encouraging sustainable practices	146	23.40
Awareness on EIA matters increase	161	25.80
Total	623	100.00

Further, 24.4% of the sample respondents said that the EIA process provides opportunity for public participation. This implies that during the EIA process of road construction, community members are given the opportunity to participate by making comments on how the

road construction should operate. It is crucial for the public to participate in the EIA process because it helps with decision-making, resolves issues, increases accountability and openness, fosters trust, and supports environmental preservation. The result is similar to findings in the study by Kanu, Tyonumm and Uchegbu (2018) who reported that the EIA process ensures that environmental issues are raised when a project or plan is first discussed and that all concerns are addressed as the project progresses.

Furthermore, from Table 3, 23.4% of the sample respondents said that the EIA process encourages sustainable practices. This result implies that the EIA process supports different activities which enhance different sustainable practices. The EIA process is intended to contribute to: sound environmental decision-making, design and construction of acceptable development projects, design modifications, and remedial measures. The findings are consistent with research by Igondova, Pavlickova and Majzlan. (2016) and Marzouk et al. (2017), which found that the EIA process ensures sustainable practices in road construction by encouraging the use of green building materials, minimizing adverse environmental effects, and educating project participants about the significance of environmental impact indicators management.

Weaknesses of EIA in road construction projects in Tanzania, based on feedback obtained from different stakeholders affected by road construction activities

During the EIA process, most of the community members indicated several challenges which may lead to weaknesses in the EIA process (see Table 4). Limited public participation of community members in the EIA meetings has been noted as the major weakness in the EIA process (37.3%). Most of the community members do not participate in these meetings; the meetings only include some community leaders, such as the Village Executive Officer and his/her officials and only a few elders in the community. This claim is corroborated by the statement made by one of the respondents that:

> "*Most of us normal community members are not involved in the EIA process/meetings, rather it involves only important people in our community. This deprives our right as important members in our village. I think this is led by the fact that whenever a person attends the*

meeting, he/she is supposed to be given some amount of money, so they keep this money for themselves"

This result is in line with the study by Pandeya (2015) who reported that in most EIA meetings, community participation is often limited to a small group of stakeholders, and that marginalized groups are often excluded from the process. The main reasons for the exclusion include lack of resources, lack of awareness of the EIA process, and lack of trust in the process. In spite of all these exclusion reasons, all people should participate in the EIA process/meetings, therefore, all challenges and barriers should be tackled.

Other weaknesses of the EIA process in the study areas were insufficient enforcement of EIA recommendations (30.7%), and lack of consideration of community needs (32%). These indicate that there is a failure in ensuring that measures are effectively carried out, and that community members' views are not taken seriously in the process. This is highly influenced by poor management of the stakeholders, and lack or insufficient resources allocated to the enforcement and community engagement aspects of the EIA process. The results are in line with the study by Den Broeder et al. (2017) who reported that most SSA countries face difficulties in implementing EIA due to constraints such as lack of resources, inadequate institutional frameworks, and lack of awareness of the EIA process, thus lack of consideration of community needs. Moreover, studies by Kakonge and Imevbore (1993) and Madlome (2016) reported that inadequate monitoring is among the weaknesses of the EIA process. This can lead to insufficient implementation of EIA recommendations to enable attainment of its full potential in promoting sustainable development.

Table 4: Weaknesses of EIA in road construction projects in Tanzania

Weakness	Frequency	Percentage
Limited public participation	175	37.30%
Insufficient enforcement of EIA recommendations	144	30.70%
Lack of consideration of community needs	150	32.00%
Total	469	100.00%

Factors affecting community people's perception in participation in EIA process in road projects

Ordinal logistic regression was conducted to analyse the factors influencing the perception of community members concerning EIA process participation.

The results presented in Table 5 show that respondents' age was statistically significant in influencing perception ($p=0.043$) and the estimate shows that a unit increase in age (1 year) increases the influence of perception 0.001 times.

The findings show that the age of the household head influences his/her perception of the EIA process. This could be explained by the fact that as age increases perceptions and attitudes towards the Environmental Impact Assessment (EIA) process may change. Older individuals may have more experience with environmental issues and may be more aware of the potential impacts of development projects on the environment. This may make them more likely to pay attention to the EIA process and to be critical of its effectiveness in identifying and mitigating environmental impacts. Additionally, older individuals may have a stronger attachment to their community and may be more concerned about its well-being. As a result, they may be more likely to participate in the EIA process, whether through public consultation or other forms of engagement. They may also be more likely to advocate for the protection of natural resources and the preservation of the local environment (Anton & Lawrence, 2016).

The findings in Table 5 also show that the family size of the household had no significant relationship with the perception on EIA process activities ($p>0.05$). Also, the influence on perception had a negative parameter estimate (-0.096). This implies that an increase in family size decreases participation and perception on EIA processes for highway road projects. A decrease in participation by larger families could be a cause for concern, as it could indicate a lack of engagement and representation in the EIA process (Olsen & Hansen, 2014).

Furthermore, gender had significant influence on respondents' perception of the EIA process ($p=0.015$). Also, this may indicate that in some cultures, men are expected to take on more public roles and responsibilities, while women are expected to focus more on domestic

duties. This could influence how men and women perceive their roles in attending EIA meetings, with men potentially feeling more pressure to attend and participate. Additionally, research suggests that men and women may communicate differently, with men tending to be more assertive and women tending to use more collaborative and inclusive language (Lin et al., 2019). This could affect how they perceive their ability to contribute effectively in a public meeting setting.

The education level of the respondents had statistically significant influence (p=0.01) on the perception of household members on the EIA process (Table 5). An increase in the education level of respondents increased perception of the EIA process 15.613 times. A higher level of education can provide community members with better understanding of the EIA process and its objectives, as well as the potential environmental impacts of projects. This may result in more informed and nuanced perceptions of the EIA process (Mango et al., 2018). Moreover, higher levels of education may also lead to greater engagement in the EIA process, as respondents may be more likely to participate in public consultations, submit comments, or seek additional information (Bawole, 2013).

Table 5: Ordinal regression results on perception on participation in the EIA process

Predictors	Estimate	Std. Error	Wald	Df	Sig.
[Overall P = 1.00]	15.56	1260.82	0	1	0.99
[Overall P = 2.00]	15.76	1260.82	0	1	0.99
Age	0.00	0.013	0.05	1	0.04
Family size	-0.09	0.08	1.26	1	0.26
[Gender=1]	0.51	0.36	2.06	1	0.01
[Gender=2]	0a	.	.	0	.
[Education=1]	15.69	1260.82	0	1	0.01
[Education=2]	0	.	.	0	.
Perception	2.42	.66	13.42	1	.00
Years of Living	-.02	.05	.18	1	.66

Conclusions and Recommendations

In conclusion, the present study demonstrated that stakeholders believe that the EIA process' primary strength is its ability to ensure that environmental concerns are taken seriously. The main weakness in the EIA process was identified as the community members' restricted public engagement in the meetings. Also, community members' perceptions of EIA process participation were significantly influenced by factors such as age, gender, and level of education.

This study recommends that the community should be better involved in the EIA process through cooperation between regulatory agencies, project sponsors, and local government representatives. To guarantee that community members, especially those who could be constrained by obstacles such as age, gender, or educational attainment, have worthwhile opportunities to engage; this may entail the creation of inclusive initiatives. Also, promoting diversity in stakeholder participation should be a top priority for EIA practitioners and regulatory agencies. A variety of demographic groups should be represented among the stakeholders involved in the process through efforts to diversify their range. Additionally, government agencies, non-governmental organizations (NGOs), and educational institutions must work together to conduct education and awareness campaigns. These initiatives should focus on raising community members' awareness of the significance and complexities of the Environmental Impact Assessment (EIA) process, particularly among those with less education.

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