Assessing the Social Economic Impacts of the Mtwara-Dar Es Salaam Natural Gas Pipeline in Tanzania

[1]Robert F. Mbangula, [2]Lucas P. Mwisila, [3]Patrick Mayala [4]Eliamini Kassembe
[1,2,3,4] Dar es Salaam Maritime Institutes (DMI) Dar es Salaam, Tanzania
rmbangula23@gmail.com
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Abstract
The study was conducted to assess the social economic impacts of pipeline construction in Tanzania, focusing on the Mtwara-Dar es Salaam natural gas pipeline. Specifically, the study was interested to evaluate the economic gains, social impacts, and long-term economic sustainability of the pipeline project, as well as to propose potential solutions to mitigate negative impacts. The findings revealed a diverse demographic profile among respondents, with varying age groups, gender distributions, educational backgrounds, and marital statuses represented in the sample. In terms of social impacts, the study identified various concerns, including increased unemployment, social conflict, and environmental degradation associated with pipeline construction. The findings underscored the complex and multifaceted nature of these impacts, emphasizing the need for robust mitigation measures and community engagement to address concerns effectively. Furthermore, the disruption of cultural tradition and environmental conservation emerged as significant issues, highlighting the importance of considering both social and environmental factors in project planning and implementation. In general, study provides valuable insights into the social-economic impacts of pipeline construction in Tanzania, highlighting the importance of considering demographic characteristics, economic indicators, and social dynamics in project assessment and planning. By addressing the challenges identified and implementing targeted interventions, policymakers and stakeholders can work towards maximizing the positive impacts of pipeline projects while minimizing negative consequences on local communities, ultimately contributing to sustainable development in the region.

Keywords*: Social, Economic, Impact, Pipeline Construction, Natural Gas*

1.0 INTRODUCTION

The discovery of natural gas in Tanzania in the past decade has brought significant economic potential to the country. The Mtwara-Dar es Salaam natural gas pipeline project, constructed by the Tanzania Petroleum Development Corporation (TPDC) and the China Petroleum Technology and Development Corporation (CPTDC), aimed to transport gas from Mtwara in the south to Dar es Salaam in the north, facilitating economic development and addressing energy shortages (Ngowi, 2015).

However, pipeline construction in Tanzania has been associated with different challenges. Environmental concerns are raised as pipelines could contribute to deforestation, pollute the air and water, and damage sensitive ecosystems (Aboud, 2015). Poor environmental management of oil and gas extraction has shown to cause significant health risks, including intestinal diseases,

birth defects, and cancers (Mrema&Ngowi, 2018). Studies have shown that communities living along the pipeline's path are more susceptible to health issues, such as stunted growth and cancer, due to exposure to toxic substances produced by gas pipelines and gas flaring (Lipumba, 2013; Kithinji et al., 2014).

In addition to environmental concerns, a lack of information and proper consultation with local communities and traditional authorities regarding pipeline projects has caused tensions and conflicts between stakeholders. In 2013, there were violent protests related to the pipeline project, leading the government to suspend the project temporarily (Ngowi, 2015). It is necessary that communities and traditional leaders are adequately informed and consulted in the decision-making processes related to pipeline construction. The involvement of local stakeholders is essential for ensuring social license and avoiding conflicts that could impact project timelines, cost, and reputation (Ongoro et al., 2018).

In Tanzania the official announcement of the large reserves of gas deposits in Mtwara District was in 2012. At the end of 2012 and the beginning of 2013, the local community of Mtwara started to show their opposition to construction of the pipeline and, finally, the picked to strike on the premise that the transportation of the natural gas to Dar-es-Salaam would not benefit the southern regions (Simbakalia, 2013). Their opposition against the government pushed the government to use force to stop the violence. During that time, some residents lost their life, and some of properties were destroyed and social economic activities were affected (URT, 2013). The civil discontent expressed in riotous demonstrations which took place in Mtwara Region were motivated by similar fears, as elsewhere, of being marginalized and left out of the new gas economy.

To address the potential negative impacts of pipeline construction, it is essential to examine the potential positive impacts as well. Pipeline construction could contribute to job creation, income generation, and local economic development. Pipeline projects require labor for construction that could provide opportunities for local people and businesses to supply goods and services. Moreover, income generated from pipelines could be used to support national and local development initiatives (Yabuki& Nakayama, 2015).Given the potential benefits of pipeline construction in Tanzania and the concerns that have arisen around the Mtwara-Dar es Salaam natural gas pipeline, there is a need for comprehensive research on the social and economic impacts of pipeline construction in Tanzania. By conducting this study, the researchers aim to fill the gap in the existing literature and provide policymakers, stakeholders, and the public with information on the benefits and challenges associated with pipeline construction in Tanzania. The region, where the pipeline is located, serves as an appropriate case study area because it is one of the regions expected to benefit most from the pipeline project.

Pipelines are critical for the transportation of natural gases, oils, and other resources that are important for economic development. While constructing pipelines can bring benefits like job creation, income generation, and infrastructure development, it can also lead to negative impacts like land acquisition disputes, environmental pollution, and social conflicts in the surrounding communities (Lima et al., 2019; Zijlstra&Schrijvershof, 2017). Tanzania has been actively involved in large-scale pipeline projects, including the Mtwara-Dar es Salaam natural gas pipeline, connecting its southern region of Mtwara to the bustling capital.

Although pipeline development is employed to leapfrog socio-economic development in the country, cases of injustice, environmental degradation continue to arise amongst its implementation. Therefore, there is a need to evaluate the socio-economic impacts of pipeline

construction, particularly the Mtwara-Dar es Salaam natural gas pipeline, and propose ways to mitigate negative consequences while fostering positive outcomes.The aim of this study is to assess the social economic impacts of the Mtwara-Dar es salaam natural gas pipeline in Tanzania.

2.0 LITERATURE REVIEW

Economic contribution theory

Economic Growth theory is a branch of economics that focuses on understanding and explaining the long-term expansion of a nation's production capacity, as measured by its Gross Domestic Product (GDP) or Gross National Product (GNP). This theory explores the factors and mechanisms that contribute to sustained increases in the total output of goods and services in an economy over time(Jones &Vollrath, 2013). Economic growth theory is relevant to the study of the contribution of pipeline construction to the social and economic aspects in Tanzania in several ways:It will provide the framework for assessing how pipeline construction affects Tanzania's overall economic output. Researchers can use GDP or other relevant economic indicators to measure the direct and indirect contributions of pipeline construction to the nation's economic growth.

Triple Bottom Line (TBL) Theory

TBL is a sustainability framework that considers three key dimensions when evaluating the impact of projects, businesses, or initiatives. These three dimensions, often referred to as the "three Ps," are People, Planet, and Profit. Applying TBL theory to the case of the Mtwara-Dar es Salaam Natural Gas Pipeline in Tanzania can provide a comprehensive assessment of its contribution to the social and economic aspects of the region(Marlon & Kenneth, 2010). Here's how TBL theory is relevant and can impact the study.

Joseph I. Uduji, Elda N. Okolo-Obasi&Simplice A. Asongu (2020), conducted the study on the role of Corporate Social Responsibility (CSR) in oil extraction communities of developing countries. It specifically examines the impact of Global Memorandum of Understanding (GMoU) interventions of multinational oil companies (MOCs) on preventing a resurgence of violence in the Ogoniland of Nigeria. One thousand, two hundred respondent households were sampled across the six kingdoms of Ogoniland. Results from the use of a combined propensity score matching (PSM) and logit model show that GMoUs of MOCs generate significant reductions on key drivers of insurgence in Ogoniland. This suggests that taking on more Cluster Development Boards (CDBs) should form the basis for CSR practice in Ogoniland with the objective of equipping young people with entrepreneurship skills, creating employment, promoting environmental clean-up, and checking the return of violent conflicts. This in turn provides the enabling environment for businesses to thrive in the Nigeria’s oil producing region.

Ahmed Tukur Umar and Moh’dShahwahid Hajj Othman (2017),conducted a study on causes and consequences of crude oil pipeline vandalism in the Niger delta region of Nigeria: A confirmatory factor analysis approach. Significant number of crude oil pipeline vandalism in the Niger delta region of Nigeria were carried out by the militant groups on the pretext for a better environmental management and development of the region. This research work examined the relation between socioeconomic, institutional factors and pipeline vandalism using confirmatory factor analysis (CFA). The CFA is a superior model of analysis since it establishes a better mathematical relationship between observed and unobserved variables compared to other models previously

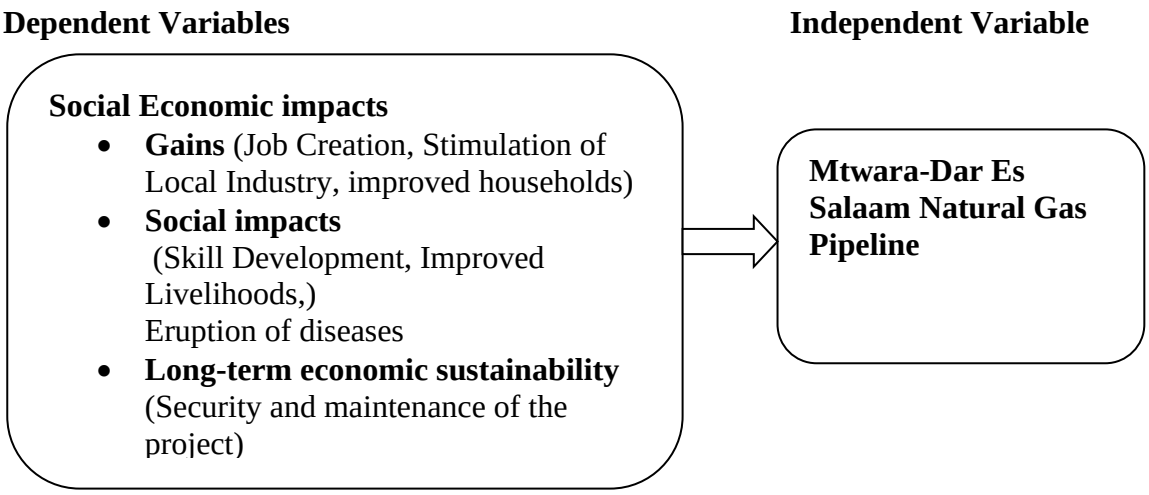
used by other studies such as correlation analysis, ordinary least squares and descriptive statistics. The study involved 97 respondents who were selected from the Niger delta region using purposive and simple random sampling techniques. The results from the study show the existence of a significant and positive relationship between poor management, poor governance, legal, and environmental degradation while significant but negative relationship between marginalization and pipeline vandalism. The study recommends the need for institutional reform through improvement in infrastructural provision, effective governance among others.

UNDP (2016) observed that despite huge financial allocations to NDDC, OMPADEC, derivation fund, less is achieved in terms of development of the region due mainly to corruption, mismanagement, lack of adequate justice and human right abuses. The expectations of achieving meaningful development through infrastructural provision, environmental protection is lacking due to poor governance. D'Agostino, Dunne, and Pieroni(2016) also arguing in line of the above pointed out that despite having abundant resources that could have benefited African countries it turn out to be resource curse which fuel conflict primarily due to poor governance.

Akpomera (2015) pointed out that weak government institutions may results in failure to protect the environment through strict environment laws ultimately leads to environmental degradation. Besides, it gives room for host community leaders and influential people to support the youths to vandalize crude oil pipelines in the name of liberating the region from government neglect. Ultimately this becomes the source of livelihood of many youths and some community leaders in the Niger delta region.

Despite the abundance of natural resources, such as gas, oil, silver, copper, and diamond, in Tanzania, the positive impacts of their extraction on the communities and the country as a whole have not been fully realized (Ndimbwa, 2014). The government's expectation of consistent revenue, citizens anticipating an improvement in their standards of living, and local communities hoping for quick relief from poverty have not been met, especially in the case of gas resource conflicts observed in fragile states (Swanepoel & De Beer, 2006). Despite the importance of understanding the impact of such conflicts on local communities and their socio-economic activities, there is a dearth of literature available on the subject in Tanzania, particularly in the Mtwara region. Therefore, the present study aims to address this research gap by investigating the impacts of the Mtwara-Dar es Salaam natural gas pipeline project on the social and economic aspects of the local community.

Conceptual Framework



Source: Researcher, 2024

3.0 RESEARCH METHODOLOGY

A case study research design was used in this Study. The sample size of 97 respondents was adopted in this study to represent the whole population.Random and Purposive sampling techniques were used in the process of selecting suitable respondents. Respondents with literacy skills in the research community were asked to complete questionnaires.

This involved local government leaders, Non-Governmental Organization Leaders, Religious leaders, environmental conservation pipeline project. The quantitative data was analyzed with an assistance of a computer package through and Microsoft excels. Microsoft tools were employed after coding data collected data. In the analysis, data was tabulated to produce percentage of responses.

Tables were used in presenting research information for interpretation whereby frequency and mean are used and discussed to give about the conclusion of the findings.

4.0 RESULTS

The rate the extent to which the following direct benefits of pipeline conduction are affecting life of the community in the project area

The researcher was interested to assess the rate the extent to which the following direct benefits of pipeline conduction are affecting life of the community in the project area. Data was collected, analyzed, presented and discussed as shown below

Table 1: Rate the extent to which the following direct benefits of pipeline conduction are affecting life of the community in the project area (5=Strongly Agree, 4- Agree, 3=Neutral, 2=Disagree, 1=Strongly Disagree)n=95

Rate the extent to which the following direct benefits of pipeline conduction are affecting life of the community in the project area	Strongly agree	Agree	Neutral	Disagree	Strongly Disagree	Mean
Job creation	13	20	21	34	7	2.978947
Economic growth	9	13	18	45	10	2.642105
Resource Transportation	19	33	18	21	4	3.442105
Efficiency	10	13	28	35	9	2.768474

Source: Field data, 2024

From table 1 above on the rate of the extent to which job creation, economic growth and resource transportation were affecting life of the community in the project area, the findings from the survey on the extent to which direct benefits of pipeline construction are affecting the life of the community in the project area reveal several key insights. Firstly, regarding job creation, the mean score of 2.978947 suggests a moderate level of agreement that the pipeline project has positively impacted employment opportunities.

However, the relatively high percentages of respondents who either disagree or strongly disagree indicate that there are concerns or discrepancies in how job creation is perceived within the community. Secondly, on the aspect of economic growth, the mean score of 2.642105 reflects a lower level of agreement compared to job creation, indicating that the perceived impact on economic growth is less pronounced.

Thirdly, in terms of resource transportation, the mean score of 3.442105 indicates a higher level of agreement that the pipeline has facilitated the transportation of resources, which is likely viewed as a positive outcome. Finally, regarding efficiency, the mean score of 2.768474 suggests a moderate level of agreement that the pipeline has improved efficiency, although there are still notable concerns or disagreements within the community. Overall, these findings highlight the nuanced perceptions within the community regarding the impacts of pipeline construction, emphasizing the importance of further study and stakeholder engagement to address concerns and maximize positive outcomes.

Rate the extent to which the following indirect benefits of pipeline conduction are affecting life of the community in the project area.

The researcher was interested to assess the Rate the extent to which the following indirect benefits of pipeline conduction are affecting life of the community in the project area. Data was collected, analyzed, presented and interpreted as shown in table 4.9 below:

Table 2: (5=Strongly Agree, 4- Agree, 3=Neutral, 2=Disagree, 1=Strongly Disagree) n=95

Rate the extent to which the following indirect benefits of pipeline conduction are affecting life of the community in the project area	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Mean
Energy security	13	20	21	34	7	2.978947
Infrastructure development	11	16	28	32	8	2.894737
Reduced congestion	8	12	18	32	25	2.431579
Environmental conservation	5	13	14	39	24	2.326316
Trade and relations	33	24	19	14	5	3.694737

Source: Field data, 2024

From table 2 above on rating the extent to which energy security, infrastructure development, reduced congestion, environmental conservation and trade and relations are affecting life of the community in the project area, the findings from the survey on the extent to which indirect benefits of pipeline construction are affecting the life of the community in the project area provide valuable insights into the perceived impacts of the project.

Firstly, regarding energy security, the mean score of 2.978947 suggests a moderate level of agreement that the pipeline has contributed to improving energy security in the community. Secondly, on the aspect of infrastructure development, the mean score of 2.894737 indicates a similar level of agreement, highlighting the positive impact of the project on infrastructure in the area.

Thirdly, in terms of reduced congestion, the mean score of 2.431579 reflects a lower level of agreement, indicating that the pipeline may not have had a significant impact on reducing congestion in the community. Fourthly, regarding environmental conservation, the mean score of 2.326316 suggests a moderate level of agreement that the pipeline has contributed to environmental conservation efforts.

Finally, in terms of trade and relations, the mean score of 3.694737 indicates a high level of agreement that the pipeline has positively impacted trade and relations in the community, which is likely viewed as a significant benefit. Overall, these findings highlight the diverse range of impacts of pipeline construction on the community, emphasizing the need for careful consideration of both direct and indirect effects in future projects.

Rate the extent to which the following effects of pipeline construction are affecting life of the community in the project area

The research was interested to assess the rate the extent to which the following effects of pipeline construction are affecting life of the community in the project area. Data was collected, analyzed, presented, and discussed as shown in table 4.9 below

Table 3: Rate the extent to which the following effects of pipeline construction are affecting life of the community in the project area (5=Strongly Agree, 4- Agree, 3=Neutral, 2=Disagree, 1=Strongly Disagree) n=95

Rate the extent to which the following effects of pipeline construction are affecting life of the community in the project area	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Mean
Unemployment to local community	23	32	21	14	5	3.568421
Prostitution	29	33	12	13	8	3.652632
Social conflict	31	33	17	14	1	3.863158
Human Rights abuse	30	16	28	15	6	3.515789
Gender based Violence	13	20	21	34	7	2.978947
Economic Effects	7	13	20	33	22	2.473684
Environmental effects	29	43	9	10	4	3.873684

Source: Field data, 2024

From table 3 above on the extent to which unemployment to local community, prostitution, social conflict, Human Rights Violence, economic effects and environmental effects are affecting life of the community in the project area, the findings from the survey on the effects of pipeline construction on the life of the community in the project area reveal several important insights.

Firstly, regarding unemployment, the mean score of 3.568421 suggests a moderate to high level of agreement that the pipeline has contributed to unemployment in the local community.

Secondly, on the issue of prostitution, the mean score of 3.652632 indicates a similar level of agreement, highlighting a perceived increase in prostitution possibly linked to the project.

Thirdly, in terms of social conflict, the mean score of 3.863158 reflects a high level of agreement that the pipeline has led to increased social conflict in the community. Fourthly, regarding human rights abuse, the mean score of 3.515789 suggests a moderate level of agreement that the project has resulted in human rights abuses. Fifthly, on the issue of gender-based violence, the mean score of 2.978947 indicates a moderate level of agreement, suggesting that while there are concerns, they may not be as pronounced as other effects.

Sixthly, regarding economic effects, the mean score of 2.473684 reflects a moderate level of agreement that the project has had negative economic effects on the community. Finally, in terms of environmental effects, the mean score of 3.873684 indicates a high level of agreement that the project has had significant environmental impacts.

These findings underscore the complex and multifaceted nature of the impacts of pipeline construction on local communities, highlighting the importance of comprehensive impact assessments and mitigation measures to address these issues.

Rate the extent to which the following social and environmental impacts of pipeline construction on local communities

The research was interested to assess the rate of the extent to which the following social and environmental impacts of pipeline construction on local communities. Data was collected, analyzed, presented, and discussed as shown in table 4.9 below.

Table 4: Rate the extent to which the following social and environmental impacts of pipeline construction on local communities (5=Strongly Agree, 4- Agree, 3=Neutral, 2=Disagree, 1=Strongly Disagree) n=95

Rate the extent to which the following social and environmental impacts of pipeline construction on local communities	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Mean
Destruction of the communities	23	40	21	7	4	3.747368
Cultural and historical deterioration	41	30	18	8	8	4.242105
Increased traffic	29	33	19	11	3	3.778947
Noise and Dust	10	13	28	35	9	2.789474
Temporary unemployment	43	26	11	04	1	3.80000
Health and safety concerns	39	22	12	15	7	3.747368

Source: Field data, 2024

From table 4 on the extent to which destruction of the communities, cultural and historical deterioration, increased traffic, noise and dust, temporary unemployment and health and safety concerns are affecting pipeline construction on local communities. The findings regarding the social and environmental impacts of pipeline construction on local communities highlight several key insights.

Firstly, concerning the destruction of communities, the mean score of 3.747368 indicates a moderate to high level of agreement that the construction has led to the destruction of communities in the project area. Secondly, on the issue of cultural and historical deterioration, the mean score of 4.242105 suggests a high level of agreement that the project has had a significant negative impact on the cultural and historical heritage of the communities.

Thirdly, regarding increased traffic, the mean score of 3.778947 reflects a moderate to high level of agreement that the project has resulted in increased traffic in the area.

Fourthly, concerning noise and dust, the mean score of 2.789474 indicates a moderate level of agreement that the construction has led to increased noise and dust pollution.

Fifthly, on the issue of temporary unemployment, the mean score of 3.80000 suggests a moderate to high level of agreement that the project has resulted in temporary unemployment in the local communities.

Finally, regarding health and safety concerns, the mean score of 3.747368 reflects a moderate to high level of agreement that the project has raised significant health and safety concerns among the communities.

These findings underscore the importance of considering and mitigating the social and environmental impacts of pipeline construction to ensure the well-being and sustainability of affected communities.

Rate the extent to which the following social and environmental impacts of pipeline construction on local communities

The study assessed to which the following social and environmental impacts of pipeline construction on local communities. Data was collected, analyzed, presented and discussed as shown below.

Table 5: Rate the extent to which the following social and environmental impacts of pipeline construction on local communities (5=Strongly Agree, 4- Agree, 3=Neutral, 2=Disagree, 1=Strongly Disagree) n=95

Impact	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Mean
Climate change	43	35	8	7	2	4.157895
Spills risks	49	27	8	8	3	4.168421
Soils erosion	39	33	18	4	1	4.105263
Air pollution	40	33	12	7	3	4.05263
Water Pollution	43	32	11	4	5	4.094737
Disruption of traditions	49	30	10	5	1	4.273684

Source: Field data, 2024

From table 5 on the extent to which climate change, spills risks, soils erosion, air pollution, water pollution and disruption of traditions are affecting the environment in the research area.

The findings regarding the social and environmental impacts of pipeline construction on local communities highlight significant concerns and perceived impacts. Firstly, concerning climate change, the mean score of 4.157895 indicates a high level of agreement that the construction has contributed to climate change, reflecting the broader environmental concerns associated with such projects. Secondly, on the issue of spill risks, the mean score of 4.168421 suggests a similar high level of agreement, emphasizing the potential environmental risks posed by the pipeline.

Thirdly, regarding soil erosion, the mean score of 4.105263 reflects a moderate to high level of agreement that the project has led to soil erosion, highlighting concerns about land degradation. Fourthly, concerning air pollution, the mean score of 4.05263 indicates a high level of agreement that the construction has resulted in increased air pollution, potentially affecting the health of local communities. Fifthly, on the issue of water pollution, the mean score of 4.094737 suggests a similarly high level of agreement, indicating concerns about the contamination of water sources. Finally, regarding the disruption of traditions, the mean score of 4.273684 reflects a high level of agreement that the project has disrupted local traditions and ways of life, underscoring the social

impacts of pipeline construction on communities. These findings highlight the need for robust environmental management practices and community engagement to mitigate these impacts and ensure the sustainability of such projects**.**

5.0CONCLUSION

Based on the specific objectives of the study, the research findings provide valuable insights into the social economic impacts of the Mtwara-Dar es Salaam natural gas pipeline construction. The study aimed to assess the economic gains, social impacts, and long-term economic sustainability of the pipeline project, as well as propose potential solutions to mitigate negative impacts. The findings reveal a diverse range of impacts on the local community, with implications for policy and decision-making.

Firstly, regarding the economic gains, the study found that the pipeline project has contributed to varying income levels among respondents, with a significant portion reporting income below 50,000 Tanzanian Shillings. While some respondents have experienced improved economic conditions, others continue to face financial constraints, indicating a need for targeted interventions to ensure equitable distribution of benefits,

Secondly, the study identified several social impacts of pipeline construction, including changes in community dynamics, cultural practices, and access to resources. The project has led to the destruction of communities, deterioration of cultural and historical heritage, increased traffic, and health and safety concerns among the communities. These findings underscore the importance of considering and mitigating social impacts to ensure the well-being of affected communities.

Thirdly, the study assessed the long-term economic sustainability of the pipeline project, revealing insights into savings behaviors and financial resilience among respondents. While some individuals have been able to save significantly, others continue to face challenges, indicating a need for sustainable development strategies that promote inclusive growth and financial stability. In general, the research findings highlight the complex and multifaceted nature of the social economic impacts of pipeline construction in Tanzania. The study provides valuable insights for policymakers, project developers, and local communities to mitigate negative effects and enhance positive outcomes, ultimately contributing to sustainable development in the region.

6.0 RECOMMENDATIONS

Based on the specific objectives of assessing the social economic impacts of the Mtwara-Dar es Salaam Natural Gas Pipeline, the following recommendations can be made.There is a need for local regional administration to evaluate the long-term economic sustainability of the pipeline project. This should include an analysis of the potential economic benefits that can be sustained over time, as well as any potential risks or challenges that could impact the project's economic viability in the future. There is a need for the government to propose potential solutions to mitigate the negative impacts of the pipeline construction project. This should include recommendations for minimizing environmental damage, addressing community concerns, and ensuring that the benefits of the project are equitably distributed among all stakeholders.

The government should engage with stakeholders, including local communities, government agencies, and project developers, throughout the assessment process. This will help ensure that the recommendations are informed by the perspectives and needs of those directly affected by the pipeline project. There is a need for the government to establish a monitoring and evaluation framework to track the implementation of the recommendations and assess their effectiveness in mitigating the negative impacts of the pipeline construction project. Regular reviews should be conducted to make any necessary adjustments to the mitigation strategies. Further studies could focus on conducting more in-depth analyses of the demographic characteristics of affected communities, including factors such as income levels, education, and employment status, to provide a more comprehensive understanding of the social economic dynamics at play.

Moreover, further investigation into the effectiveness of specific mitigation strategies, such as community engagement initiatives and benefit-sharing mechanisms, would help identify best practices for minimizing negative consequences and maximizing positive outcomes.

Policy implication

There is a need for thorough impact assessments before initiating pipeline projects, considering both direct and indirect effects on local communities. This includes evaluating job creation, economic growth, resource transportation, and efficiency improvements, as well as potential negative impacts such as unemployment, social conflict, and environmental degradation. Policymakers should prioritize community engagement and participation throughout the project lifecycle to ensure that local voices are heard and concerns addressed. Transparent communication channels should be established, and benefit-sharing mechanisms should be implemented to ensure that communities benefit equitably from pipeline projects.

Additionally, robust environmental management practices should be enforced to mitigate environmental impacts and protect ecosystems, water sources, and wildlife habitats. Collaboration with stakeholders, including governments, NGOs, and local communities, is crucial for aligning pipeline projects with sustainable development goals and ensuring positive long-term outcomes for affected communities.

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