

# Fundamental Decision Chains for Harnessing Natural Gas Resources for Sustainable Development of Tanzania

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**Abstract:** *Harnessing natural gas resources for sustainable development requires undertaking fundamental decision chains. The role of the government in championing strategic decisions in the management of these resources to spur social and economic growth is of critical importance. Without proper decision chains, natural gas resources paradoxically may undermine development. The study found that the findings from both closed ended and open-ended results have the implication for adequate decisions the government may take in managing the natural gas resources for long-term social and economic development. The study suggests that in order to accelerate social and economic development of Tanzania, natural gas revenues should be accounted for and wisely use to finance long-term development projects and for an accelerated transition out of poverty.*

**Keywords:** *Decision Chain, Natural Gas resources, Sustainable Development, Tanzania.*

## 1. INTRODUCTION

The discovery and extraction of natural gas resources have increased the potential to finance rapid, sustained and broad-based development around the world. Many resources-rich countries in the world have been struggling to ensure that these resources are managed in the way that they contribute significantly to socioeconomic development. Developed Countries such as USA, Canada, Norway, and Mexico, whose effective management of oil and gas resources have contributed to their economic and social development (Badeeb, Lean, & Clark, 2017; Parlee, 2015). The level of development realized by Middle East and Asian countries like Indonesia and Malaysia manifests on proper management of oil and gas resources (Doraisami, 2015). However, despite abundant reserves of natural resources in most African resource-rich countries except Botswana paradoxically have jeopardized the economic growth and social and political stability (Hammond, 2011; Itriago, 2009; Ohno, 2010; Siakwah, 2016).

The fundamental focus for harnessing these resources is enshrined in the desire to achieve sustainable development among the resource-rich countries, developing countries in particular. In this, endeavour, Sustainable Development efforts compel resource-rich country to manage effectively the gains accrued from natural gas so that it contributes significantly to economic and social development. On one hand, Literature suggests that proper management of oil and gas resources to stimulate economic growth and bring social development to the community (ROSIEK, 2016; Schneider et al., 2015). On the other hand, natural gas resources paradoxically have been a source of conflicts, social unrest and economic stagnation, especially in most African resource-rich countries (De Soysa & Gizelis, 2013; Goumandakoye, 2016; Gross, 2014; Siakwah, 2016; Zeng & Zhan, 2015).

The recent discovery of enormous natural gas and massive extraction on progress in the Southern regions of Tanzania ignites the desire for effective management of these resources so that they contribute significantly to sustainable development of the nation. A major discovery of gas witnessed since 2010 and subsequent explorations undertaking from both on- and offshore basins, deep-sea onshore and shallow waters, deep offshore and inland rift basins is a clear manifestation of abundance of these resources in Tanzania. Indeed, the discovery of natural gas reserves not only puts Tanzania among the producers of energy in the world, but also the contributor of social economic development. Harnessing these resources for sustainable development of Tanzania becomes the main agenda of the government and an expectation among Tanzanians. Therefore, informed government decisions at all stages of resource development, from setting the terms for discovery and extraction through to investing revenues and promoting economic development and diversification is imperative. In realization of the social and economic value of these resources, the government of Tanzania has put in place commendable efforts for managing these resources for the benefits of Tanzanians generations. These include establishment of operative legislations and policies to govern the management of oil and gas resources. In addition, National Oil Company have been established to supervise the management activities of the petroleum industry. Likewise, some regulatory institutions such as EWURA and PURA established to regulate lower, mid and upstream Petroleum activities. TEITI to monitor issues of Transparency and accountability as well as Oil and Gas Revenue Management Fund established to manage all revenues accrued from any activity related to oil and gas extraction.

Despite these efforts, still Tanzania is among the poorest country in the world. The reasons for this are manifold. One reason evidenced is poor management of natural resources including natural gas (Márquez-Velázquez & Magai, 2011). Secondly, inadequate or poor decisions chains for harnessing natural resources for sustained growth of the country. Third, Tanzania resorted into the extraction of oil and gas resources unprepared in many areas. In fact, these reasons pose potential challenges for the achievement of the national development plans such as the five-year plan 2016/17 – 2020/21, Tanzania National Vision 2025 and the Tanzania promise of becoming middle country by increasing its GDP per capital of about \$600 in 2014 to around \$3000 in 2025. Achieving sustainable development therefore requires the government of Tanzania to make a series of decisions sufficiently right. Henceforth, though, experiences show failure of most developing resource-rich countries to manage these resources, the same experiences from those managed to avoid the paradox, Tanzania should apply. Apparently, decision chains for harnessing these resources for Sustainable development should originate from Tanzania while drawing the best practices and solutions for mitigating the potential challenges for harnessing natural gas resources for sustainable development of the most successful countries. This study, therefore, examines the fundamental decision chains for harnessing these resources for sustainable development of Tanzania. The central motivation is to determine how natural gas and associated revenues may bring a profound impact in the prosperity of Tanzania economies. The study intends to inform policy makers on the best decision chains to take to avoid the recurrence of plunder and take full advantage of the unprecedented opportunity of new resource discoveries.

## **2. LITERATURE REVIEW**

This part presents an understanding of the key concepts used in this study, including sustainable development, decision chains and a brief description of the oil and natural gas sector in Tanzania. The ultimate goal of the study is sustainable development of Tanzania. Therefore, having abundance, natural gas alone does not prompt sustainable development, rather undertaking a series of decision chains for harnessing these resources, may lead to socio-economic development and prosperity of the country.

### **2.1 Sustainable Development**

Advocates of the Sustainable development have coined the concept as an alternative development strategy for improving the living conditions of the world human population. The UN Conference on Human Environment held in Stockholm in 1972 originated the concept of sustainable development (Hugé, Waas, Dahdouh-Guebas, Koedam, & Block, 2013; Wheeler, 2013). Since the UN Stockholm conference, the concept has gained momentum as

the world development agenda. Many scholars have tried to come up with different arguments about the precise nature and meaning of sustainable development. (Cetinkaya, Kambu, & Nakamura, 2014; E. Holden, Linnerud, & Banister, 2016) refers sustainable development as the new paradigm or a philosophy of the 21<sup>st</sup> economic, social and environmental management. (Tolba, 2013) advances that sustainable development denotes the world overarching policies, regulations, and principles that embraces a long-term benefit of the present and future generation. (Desa, 2012) describes sustainable development as a deliberate effort of developing countries to realize socio-economic development and environmental protection for sustained benefits of the future generations. Likewise, (Virakul, 2015) considers Sustainable Development as a series of development policies and principles aimed at meeting the needs of the present without misusing the resources of future generations. However, the most frequently used definition of Sustainable development has been from the Brundtland Report that referred Sustainable development as the development that meets the needs of the present (people) without compromising the ability of future generation to meet their own needs. (Brundtland & Khalid, 1987; Stoddart et al., 2011). In other words, sustainable development entails improving the quality of life of the present generation without excessive use or abuse of natural resources, so that they can be preserved to cater the needs of the present as well the future generations (Newton, 2004; Rogers, Jalal, & Boyd, 2012). Based on the Brundtland definition, harnessing natural resources for sustainable development becomes the most pressing agenda for sustainable development in the world.

### **2.1.2 Models of Sustainable Development**

Scholars describe Sustainable development in four interrelated models such as the Three-Pillar Model (Keiner, 2005), Prism Model (Nurse, 2006; Scerri & James, 2009), Nested or Egg of Well-being Model (Guijt & Moiseev, 2001; Lozano, 2008), of sustainable development. The models show the link between factors describing the best ways of achieving sustainable development. However, for the best of this study, only the Three Pillar Model of Sustainable Development preferred. In fact, the sustainable development concept is well presented using the Three Pillars Model (TPM) (Keiner, 2005) and (United Nations World Summit, 2005). This model is represented as pillars, overlapping circles, or a triangle to include economic development, social development and environmental protection mostly labelled as the three basic requirements for sustainable development (Thatcher, 2014). (Scottish Environment Protection Agency 2002) by (Dawe & Ryan, 2003) provides a simple way of visualizing sustainable development as to think of it as a stool with three legs, representing the environment, economy, and society. It

strongly argued that if any leg is more or less important (i.e. Shorter or longer) than the others, the stool will be unstable (but perhaps still usable at least for a while). If any leg is missing, the stool simply will not work. However, if all three legs are the same length (i.e., Environmental, economic and social considerations have been given equal weight), the result will be a well-balanced stool which will serve its purpose indefinitely a sustainable stool. The three Pillar Model is also described as “The Triple Bottom Line (TBL)” which originated at the Earth Summit in Rio de Janeiro in 1992, articulated in 27 principles (Gopalakrishnan, Yusuf, Musa, Abubakar, & Ambursa, 2012; Markley & Davis, 2007; Presley, Meade, & Sarkis, 2007). The Triple Bottom Line indicates giving equal attention to economic, environmental and social bottom line of sustainability in the company’s operations (Arena & Azzone, 2010; Glac, 2015; Hall, 2011; Henriques & Richardson, 2013). In a simple

way, this model provides the nexus of the three basic elements of Sustainable Development, namely the economy, social and environmental sustainability (Huge et al., 2011; Musson, 2013; Nyfeler, 2013; ROSIEK, 2016; Teodorescu, 2012), well shown in table 1. Evidently, the model is derived based on the struggle of developing countries to realizing economic growth, reducing poverty and delivery of quality social services to citizens, attracting Foreign Direct Investment (FDI), employment, technological transfer, participation of the local businessmen in supply chain especially in all big tiers of the economy and protection of the environment. Similarly, the model shows that Sustainable development is about the integration of development indicators in a way that best befits the broadest possible range of sectors, across borders and even between generations (Insights, 2008).

Table 1: Description of Three -Pillar Model of Sustainable Development

Pillars	Description
<b>Economy</b>	<i>An economically sustainable system must be able to produce goods and Services on a continuing basis, to maintain manageable levels of government and external debt, and to avoid extreme sectoral imbalances, which damage produces from another sector of the economy.</i>
<b>Environment</b>	<i>An environmentally sustainable system must maintain a stable resource base, avoiding over-exploitation of renewable resource systems or environmental sink functions, and depleting non-renewable resources only to the extent that the investment made inadequate substitutes. This includes the maintenance of biodiversity, atmospheric stability, and other ecosystem functions not ordinarily classed as economic resources</i>
<b>Social Community</b>	<i>A socially sustainable system must achieve distributional equity, adequate provision of social services including health and education, gender equity, and political accountability and participation</i>

Source: Thatcher, 2014

In fact, any resource rich country wishes to achieve the three pillars, therefore a set of decision chains in the management of the natural resources should be taken in order to spur the intended purpose.

**2.2 Decision chains**

The decision chain refers to the process of converting natural resources into long-term sustainable development, from exploration and discovery, to spending the revenues and promoting economic development and diversification (Collier & Antonio., 2013, NRC., 2011). The focus of decision chain is tied to the output of better development as opposed to more valuable tradable goods. The extractive industry decision chain is the set of decisions countries face

along the way when trying to convert the natural resources under the ground into better development above the ground (Collier & Antonio., 2013). The decision chain approach has been popularized to stress the key steps in ensuring that natural resource wealth transforms into citizen well-being (NRGI, 2015). The process begins with the decision of whether to extract and includes the questions of how to allocate rights to extract, how to generate revenues and other benefits, and how to manage the revenue from the extraction. The motivation for outlining these decisions is that many resource-rich countries have trouble realizing the full development potential of their resource wealth. Articulating the decisions helps governments and oversight actors understand where they can effect change (Uongozi Institute, 2013).

Several approaches have been developed to inform the series of decision chains that should the resource rich countries pursue. In order to achieve sustainable growth, (Uongozi Institute, 2013) provides five steps of the chain, as follows; managing the discovery of resources, capturing the value of the resources extracted and managing local communities in the areas where resources are extracted. Other steps include, achieving the right balance between present consumption of resource revenue and saving for the future, and using accumulated savings for productive investment. Moreover, the International Growth Centre (2015) describes five chains in the process of discovery of natural resources. These include discovering, exploiting, Taxing, investing in investing, and investing.

**2.3 Oil and Natural Gas in Tanzania**

Exploration of oil and gas resources in Tanzania has a long history. The first gas discovery made at Songo Songo Island in Lindi region in the 1970s, followed by further discoveries at Mnazi Bay in Mtwara region in 1982 and Mkuranga District in 2007 (Strong, 2013). Over recent, since 2010 there has been the massive discovery of oil and gas resources in Tanzania which puts the country on the world map as a potential player of global oil and gas business (Poncian, 2013). Apparently, the major discovery of natural gas and its subsequent extraction have brought much excitement among Tanzanians (Bofin & Pedersen, 2017). As of June 2013, natural gas discoveries of about 42.7 TCF (7.5 billion Barrels of Oil Equivalent – BoE) been made from both on- and offshore basins. Furthermore, the deep-sea discoveries have brought about new exploration targets for hydrocarbons in Tanzania and the whole of the Western Indian Ocean Region (URT, 2013). Currently, there are massive activities taking place onshore and shallow waters, deep offshore and inland rift basins. Statistics confirm that up to December 2012, there were 26 Production Sharing Agreements (PSAs) signed with 18-oil exploration

companies. Over 110,000 km of 2D seismic data have been acquired onshore, shelf, offshore as well as from inland rift basins. As of February 2013, the 21,632 square kilometres of 3D seismic data being acquired from the deep sea, 67 wells for both explorations (URT, 2013). Furthermore, various laws, policies and Regulations to manage the natural gas resources in Tanzania have been in place. Some include (1) The Constitution of the United Republic of Tanzania, 1977, (2) The National Natural Gas Policy of Tanzania, 2013; and (3) Local Content Policy for Oil and Gas Industry, 2014. Others are (4) The Petroleum Act, 2015; (5) National Energy Policy, 2015; (6) Oil and Gas Revenues Management Act, 2015; as well as, (7) Extractive Industry (Transparency and Accountability) Act, 2015. Besides, Oil and Natural gas are a finite resource which needs urgent care. Its extraction should benefit the present and future generations. Proper management of these resources, therefore, requires effective governance system involving overarching fundamental decision chains.

**3. MATERIALS AND METHODS**

This part presents the materials and methods employed in conducting this study. The materials and methods employed in this study are intended to answer the main research question; (1) what decision chains are imperative for harnessing oil and gas resources for sustainable development of Tanzania?.

**2.1 Study Area and Sample Description**

The study was conducted in the United Republic of Tanzania targeting 300 participants randomly selected from (9) nine categories of respondents based on the perceive knowledge they have regarding natural gas management in Tanzania.

*Table 2: Sample Characteristics of the Study*

<i>Participant Category</i>	<i>n</i>
Ministry of Energy	30
Tanzania Petroleum Development Corporation	30
PURA	20
Tanzania Extractive Industries Transparency and Accountability	20
International gas Companies	20
Mtwara Municipal Council	65
Mtwara District Council	65
Academicians	30
Civil Organizations	20
<b>Total</b>	<b>300</b>

**2.2. Data Collection and Analysis**

A pre-designed questionnaire was used to obtain information from participants concerning decision chains for harnessing natural gas resources for sustainable development

of Tanzania. The questionnaire comprised of both open and closed-ended questions. For a closed-ended question, participants were assessed based on their ratings of the key variables presented. The questionnaire item was designed in a Likert scale format (1-4) where 4 represented strongly agree, 3 Agree, 2 disagree and 1 strongly disagree. Similarly, the question required participants to state additional factors, which deemed important to be included in the study. The procedure for soliciting information involved tracking and listing each emergent factor in a specific table. SPSS was used to analyse data collected through closed-ended question where descriptive statistics were performed to present data of this nature. Frequencies and percentages were used to

present participants in response rates and demographic information. However, no particular coding was performed for analyzing open-ended results rather; a frequency distribution table was used to present the results. In this case, all responses (emergent themes) were recorded and similar responses were merged to facilitate presentation and discussion.

**4. RESULTS AND DISCUSSION**

Part 4 presents study results and discussion. Among 300-targeted participants, 250(83.3%) responded to the questionnaires. Table 3 indicates the number of responses according to category of respondents.

*Table 3: Participants’ Response Rate*

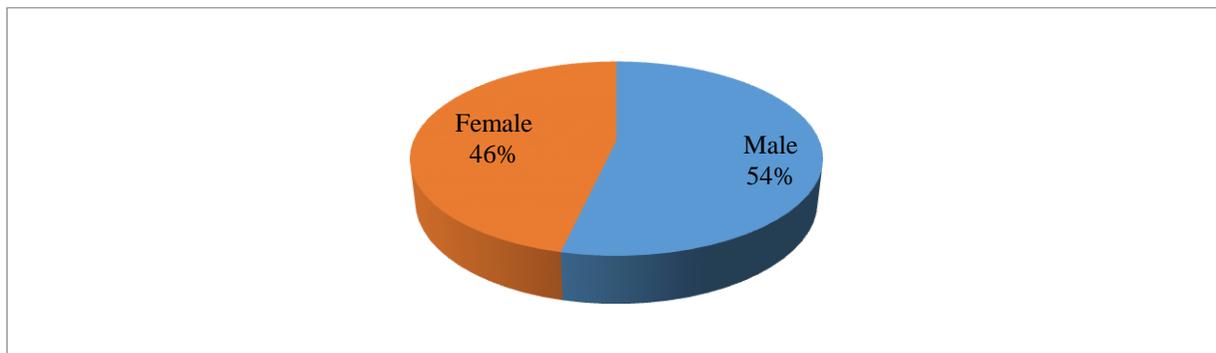
<i>S/N</i>	<i>Respondents</i>	<i>n</i>
1.	Ministry of Energy	25
2.	Tanzania Petroleum Development Corporation	23
3.	PURA	18
4.	Tanzania Extractive Industries Transparency and Accountability Authority	17
5.	International Oil Companies	8
6.	Mtwara Municipal Council	59
7.	Mtwara District Council	60
8.	Academicians	25
9.	Civil Organizations	15
<b>Total</b>		<b>250</b>

Table 3 suggests majority participants (83.3%) responded in a significant number in all nine categories. (Mugenda, 2008) states, for analysis, reporting a response rate of 50% is adequate; a rate of 60% is good, and a response rate of 70% and above is excellent.

**4.1 Demographics: Sex and Age of Respondents**

A total of 250 respondents indicated their gender and age. Figure 4 shows the distribution of respondents in terms of sex by age.

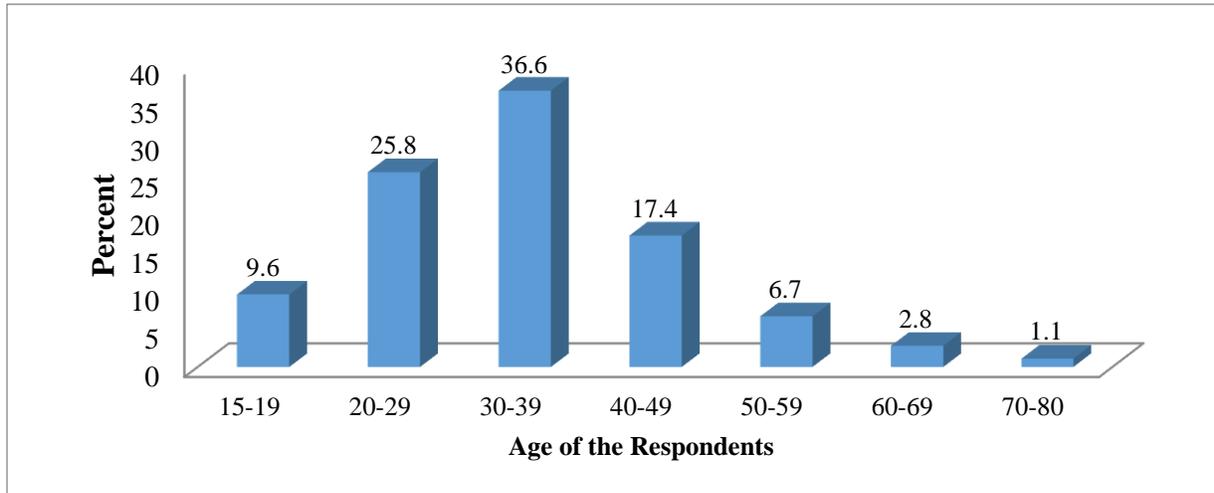
*Table 4: Sex of Respondents*



From the findings, 54% of the respondents were male, while 46% were female as table 5 indicates. This indicated

that the study was not gender biased since both male and female were fairly represented.

Table 5: Age of Respondents



From the findings, of the respondents, 9.6% were aged 15-19 years, 25.8% were aged 20-29 years, 36.6% were aged 30-39 years, 17.4% were aged 40-49, 6.7% were aged 50-59 years, 2.8% were aged 60-69 years, and 1.1% were aged 70-80 years. From the findings is evident that the study used respondents of different ages with the majority being aged between 30-39 years.

#### 4.2 Decision chains for Harnessing Natural Gas Resources for Sustainable Development

We present and discuss both closed and open-ended results concurrently. However, we use evidences from the literature to support the discussion. Descriptive statistics Tanzania.

were used to present results from closed ended items, while frequency distribution was used to present results from open-ended question.

#### Descriptive statistics

Participants were required to rate the variables entailed decision chains for harnessing natural gas resources for sustainable development of Tanzania. Ten variable in Likert scale form (1-4) were presented alongside the question as table 1 indicates. Results show that majority (participants) positively rated the variables as imperative for harnessing natural gas resources for sustainable development of

Table 6: Decision Chains for harnessing natural Gas Resources in Tanzania

Decision Chains	1	2	3	4	Mean	Std. Dev.
1. Undertaking natural gas resource based development Planning and strategies for implementing relevant policies	12	17	89	139	3.392	1.010
2. Develop a robust legal framework and competent institutions to manage natural gas resources	12	16	99	123	3.332	0.918
3. Ensure proper Revenue Accountability and Transparency	12	28	96	127	3.285	0.872
4. Ensure local communities, local governments and businessmen participation in decision chains	19	19	86	139	3.312	0.951
5. Ensure Transparency in allocation of rights and efficient exploration and production operations	13	17	104	129	3.327	0.914
6. Ensure smooth domestic spending of revenues to account for revenue volatility	12	27	97	127	3.289	0.875
7. Invest revenues to achieve optimal and equitable outcomes for current and future generations	15	28	90	129	3.259	0.875
8. Ensure effective use of natural gas revenues as an opportunity to increase the efficiency of public spending at the national and subnational levels	13	23	102	125	3.289	0.875

9.	Implement flexible Tax regimes and contractual terms of attracting necessary investment	15	10	95	115	3.060	0.811
10.	Pursue opportunities for local benefits and offset the environmental and social costs of natural gas extraction projects	16	11	98	125	3.328	0.936

Table 6 indicates the participants' level of agreement on the decision chains for harnessing natural gas resources for sustainable development of Tanzania. Results show that majority of participants' ratings fell under agree and strongly agree while the overall mean score among ten variables ranges from 3.060 to 3.392 and Standard deviation ranges between 0.811 and 1.010. This signifies the positive response of the participants of the rated decision chains that they are imperative for harnessing natural gas for sustainable development of Tanzania as explained herein below.

Undertaking natural gas resource based development Planning and strategies for implementing relevant policies. According to descriptive statistics, the respondents' agreement is positive that undertaking natural resource based development planning and strategies for implementing relevant policies as shown by ( $M=3.392$ , and  $SD=1.010$ ,  $n=250$ ) is an important decision in harnessing natural gas resources for sustainable development of Tanzania. It is obvious that natural gas extraction yield revenue to the government. In this case, natural gas management requires undertaking a careful resource based development planning. One way of instituting this approach as suggested by (Collier & Antonio., 2013) is to have a shared national gas strategy concomitant to a vision with clear and realistic goals, timelines and indicators of achievement. Besides, robust policies and implementation strategies should be the vehicle for attaining this objective. Since, extraction of natural gas and its subsequent stages of exploration, promotion, development, production and beneficinations takes a long time; and has been associated to distinct social, economic and environmental impact to the community, long term development planning of managing the resource is preferred. In fact, natural gas development planning informs the country on effective use of revenues for social and economic development. However, even if there are abundant natural gas resources in a country, and the fact that the government may raise a large amount of revenue, if there is no substantial planning of its use the country may not realize its desired development. The government, therefore, should consider to include natural gas resource based development planning and strategies for implementing relevant policies in the entire decision chain.

According to the legal framework, 99(39.6%) participants agreed and 139(50.8%) strongly agreed that developing a robust legal framework (rules, policies and regulations) and competent institutions to manage natural gas resources is significant for harnessing natural gas

resources for sustainable development of Tanzania. The results suggest that for Tanzania to benefit from gas resources, the legal framework must be robust enough to enable the country reap large benefits from the extraction of natural gas. In addition, the government should develop the capacity of the regulatory institutions (PURA, TEITI, and EWURA), oversight organs (CAG and PCCB) and the TPDC in terms of finance, technical and human resource. As for ensuring proper Revenue Accountability and Transparency descriptive results shows that participants rating falls under agree and strongly agree as shown by mean score of 3.285. These results indicate that ensuring natural gas revenue accountability and transparency is necessary for sustainable development of Tanzania. Similarly, ensure transparency in the allocation of rights and efficient exploration and production operations, which the participants rated positively ( $M=3.285$ ,  $STD=0.872$ ,  $n=250$ ) is significant for managing natural gas resources. However, stakeholders' involvement and participation in all process of the decision chains is imperative for ensuring that natural gas benefits the entire Tanzania population. Results show that 89(34.4%) participants agreed and 139(55.6%) strongly agreed that ensuring local communities, local governments and businessmen participation in natural gas management is significant for enhancing long term benefits and development of the country.

Moreover, results indicate the need for proper natural revenues is important for sustainable development of Tanzania. According to table 4.3 three factors are responsible for revenue management. Ensure smooth domestic spending of revenues to account for revenue volatility as shown by mean score of 3.289 and invest revenues to achieve optimal and equitable outcomes for current and future generations as shown by mean score of 3.259. Also, ensure effective use of natural gas revenues as an opportunity to increase the efficiency of public spending at the national and subnational levels as shown by mean score of 3.289. The overall results suggest that ensuring that effective fiscal rules for managing revenue are in place, is significant for sustainable development of Tanzania. This necessitates the need to cap spending from oil revenues, to create rules on allowable investment in the existing revenue management fund and create clearer plans based on the anticipated natural gas revenue and the existing development plans. Though it is the reality that Tanzania have large development financing gaps, and natural gas revenues can go a long way toward filling these gaps, designing effective revenue management strategies is necessary. Therefore, strategies for balancing spending, stabilizing and serving of natural gas revenues is of critical importance. Besides, oversight organs of the state such as PCCB, CAG and TEITI

have a significant role to play in ensuring that natural gas promotes social and economic development of Tanzania. However, a well-organized and effective civil society, community is particularly important in ensuring the effective management of natural gas and for holding governments to principles of transparency and accountability of natural gas revenues. Lastly, implementing flexible Tax regimes and contractual terms of attracting the necessary investment as shown by mean score of 3.060, and pursuing opportunities for local benefits and offset the environmental and social costs of natural gas extraction projects as shown by mean score of 3.328 are critical factors to consider in the entire natural gas decision chain.

**4.3 Emergent factors from open-ended question**

Alongside the closed questions, participants were asked to state additional factors for harnessing natural gas resources for sustainable development Tanzania, where 155 (46%) participants participated. In fact, participants raised many factors but for effective analysis, repeated or similar factors were merged. However, emphasis was given only to factors, which observed to have a high frequency. Based on the analysis, factors were reduced to seven (7) as table 7 indicates.

Table 7: Emergent Factors from Open-Ended Question

No.	Emergent Factors	f
1.	Establish robust rules and institutions	88
2.	Ensure effective and prudent use of revenues to support development projects	112
3.	Institute effective audit systems of gas revenues.	65
4.	Ensure participation of citizens and businessmen in the oil and gas sector	93
5.	Enhance Transparency and Accountability mechanisms in the gas sector	75
6.	Ensure constant supply of Gas Resources for Domestic and Industrial use	16
7.	Enhance Accountability for Decision Making and Performance	41

**Establish robust rules and institutions**

Eighty-eight (88) participants as shown in table stated establishing robust rules is an important factor for harnessing

natural gas resources for sustainable development of Tanzania to be included the decision chain process. Table 8 indicates participants’ response rate for Building robust rules and institutions.

Table 8: Building robust Rules and Institutions

Age of Respondents	n	Percentage	Sex of Respondents	
			Male	Female
20-29	11	13	7	5
30-39	27	30	18	9
40-49	25	28	16	9
50-59	19	22	11	8
60-69	6	7	4	2
<b>Total</b>	<b>88</b>	<b>100</b>	<b>56</b>	<b>32</b>

Table 8 indicates that among 88 participants, 11 (13%) participants were 20-29 years, 27(30%) were 30-39 years, 25(28%) were 40-49 years, 19(22%) were 50-59 years, and 6(7%) participants 60-69 years. However, 56(63.6%) participants were male, and 32(36.4%) were female. The overall results indicate an even distribution of participant’s responses across ages and gender.

Based on the responses, participants emphasize that the government needs to build robust and institutions and ensure

wide stakeholder support. The majority posited that the rules and policies developed should be developed in a way that it facilitates effective decision-making processes in the management of the resources. Furthermore, participants believe that organs involved in the decision chains including the Ministry of Energy and its affiliated institutions, the parliament, civil organization and citizens should play a pertinent role in ensuring that potential decisions taken in all processes should conform to established policies and regulations, and should benefit the country. However, what

makes harnessing natural gas resources a weakest link problem to cause blockage of the chain is that, most decisions taken are interdependent, but are taken separately by different people or institutions. Further, participants suggested harmonizing the roles and responsibilities entrusted to different institutions like Ministry of Energy, TPDC, PURA, TEITI, EWURA and the President’s Office to mitigate the possible interferences in the decision-making processes. Moreover, the parliament should play a significant role in making sure that revenues obtained from all processes of extraction of natural gas accounted for, and used wisely for the national development. Consequently, politicians, especially ministers of finance should be locked for commitment to mitigate the possibility of plundering the revenues. This may as well promote integrity in the revenue use and, reduce the risk of the money saved by prudent

bodies or individuals not plundered by institutions or any other organs of the government for individual benefits. Participants, therefore, believe that strong political actions need be taken to build the institutions that maintain the integrity of the natural resources management rules and policy chain.

**Ensure effective and prudent use of revenues to support development projects**

One hundred and three (103) participants mentioned ensuring the effective and prudent use of revenues as an important factor for harnessing natural gas resources for sustainable development of Tanzania. Table 9 show shows participants’ responses in terms of age and sex.

Table 9: Effective and prudent use of revenues

Age of Respondents	n	Percentage	Sex of Respondents	
			Male	Female
15-19	8	8	4	4
20-29	10	10	7	3
30-39	35	34	22	13
40-49	29	28	17	12
50-59	16	15	10	6
60-69	5	5	3	2
<b>Total</b>	<b>103</b>	<b>100</b>	<b>63</b>	<b>40</b>

Table 4 indicates that among 103 participants, 8(8%) were 15-19 years, 10 (10%) participants were 20-29 years, 35(34%) were 30-39 years, 29(28%) were 40-49 years, 16(15%) were 50-59 years, and 5(5%) participants 60-69 years. However, 63(61.2%) participants were male, and 40(38.8%) were female. The overall results indicate an even distribution of participant’s responses across ages and gender.

Results indicate that most participants believe in ensuring the efficient and effective use of gas revenues. The results suggest an agreement among the participants that effective and prudent use of oil and gas revenues is a fundamental factor for realizing sustainable development of the Tanzania. Most of them pointed that when revenues are effectively and prudently used, it will cater for socio-economic development, hence benefit the present and future Tanzanian generations. (Abdulai, 2013) states that accountability and effective use of revenues from oil and gas enables the country to measure its optimum gains to realize its contributions to the national growth. Similarly, most participants indicated that prudent use of oil and gas revenue is the heart of the sustainable development of Tanzania. They are concerned about the use of revenue so that it used to solve social and economic challenges prevailing in Tanzania. In this regard, participants' hopes that revenues

obtained from oil and gas are not squandered, as such, be wisely used to support social-economic developments. They, therefore, believe in imposition of strict laws, regulations and strong oversight institutions to monitor, report and or propose legal actions against misappropriations of the oil and gas revenues or any deal set forth. One participant stated clearly that “...prudent and effective budget planning; revenue collection and prudent use of revenue may lead to sustainable development of the country”. Therefore, oversight organs of the country should play a significant role in ensuring that there no any revenue obtained from natural gas activities is plundered.

Besides, participants expect that the revenue accrued from oil and gas should be invested in economic and social projects. Most stated that investing large shares of natural gas revenues into infrastructure and other forms of capital might support long-term growth of the country. Some participants stated that since the government have started to effectively depleting assets in the ground, there is thus a powerful case to be made for those revenues to generate at least equally valuable assets on top of the ground. One participant posited, “...investing natural gas revenues to social and economic projects, is fundamental to building citizens trust and therefore trigger their effective participation in all processes”. In addition, other

participants listed that investment of revenues in social and economic projects will be achieved only if revenues collected are transparently reported and accounted for. Participants, therefore, stated that ensure effective investment of revenues, the government should build strong institutions and rules, and ensure the citizen body supports them. In this endeavour, strong political actions are necessary to build and maintain the integrity of the natural gas management rules and policy chain and to ensure natural gas wealth used to support inclusive social and economic growth.

**Institute effective audit systems of gas revenues**

Sixty-Five (65) participants stated institute effective audit systems of gas revenues is an important factor for harnessing natural gas resources for sustainable development of Tanzania to be included the decision chain process. Table 10 indicates participants’ response rate on instituting effective audit systems.

Table 10: Effective Audit Systems

Age of Respondents	n	Percentage	Sex of Respondents	
			Male	Female
15-19	3	5	1	2
20-29	13	20	8	5
30-39	22	33	13	9
40-49	15	23	9	6
50-59	11	17	7	4
60-69	1	2	0	1
<b>Total</b>	<b>65</b>	<b>100</b>	<b>38</b>	<b>27</b>

Table 10 indicates that among 65 participants, 3(5%) were 15-19 years, 13(20%) participants were 20-29 years, 22(33%) were 30-39 years, 15(23%) were 40-49 years, 11(17%) were 50-59 years, and 1(2%) participants 60-69 years. However, 58(58%) participants were male, and 27(42%) were female. The overall results indicate an even distribution of participant’s responses across ages and adequate representation among male and female. Based on these results, ensuring good governance of natural gas resources, effective and regular audit of oil and gas transactions should be effectively taken throughout the entire decision chain process. In fact, the results suggest that instituting effective and regular audit systems in all businesses surrounding gas sector will yield long-term social and economic development. Results. Participants strongly maintained that effective and regular audit systems are paramount for proper management of oil and gas revenues. One participant stated “.....to realize long term benefits of natural gas, the Controller and Auditor General’s office should professionally perform the duty of auditing all

revenues accrued from oil and gas business and expose any misappropriations or procedural noncompliance”. Participants believe that conducting regular audit of natural gas activities will promote compliance and integrity in conducting natural gas business. Indeed, these results show positive and optimistic thinking of participants that when there is an effective and regular audit of all deals, for example, revenues and its accompanying transactions, Tanzania may certainly realize sustainable development of the oil and gas resources. Thus, participants hope that these systems will be the cure for corruption and mismanagement of the revenues.

**Ensure participation of citizens and businessmen in the gas sector**

Responses from ninety three (93) participants as shown in table 11 indicate that sustainable development, participation of citizens and businessmen is vital in stimulating social and economic growth of the sector and the Tanzania economy in general.

Table 11: Ensure Participation of Citizens and Businessmen in the gas sector

Age of Respondents	n	Percentage	Sex of Respondents	
			Male	Female
15-19	7	8	3	4
20-29	16	17	8	8
30-39	28	30	15	13
40-49	22	24	13	9
50-59	16	17	8	8
60-69	4	4	3	1

<i>Total</i>	<i>93</i>	<i>100</i>	<i>50</i>	<i>43</i>
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Table 11 indicates that among 93 participants, 7(8%) were 15-19 years, 16(17%) participants were 20-29 years, 28(30%) were 30-39 years, 22(24%) were 40-49 years, 16(17%) were 50-59 years, and 4(4%) participants 60-69 years. However, 58(54%) participants were male, and 43(46%) were female. The overall results indicate an even distribution of participant’s responses across ages and adequate representation among male and female.

Results show that the participation of citizens and businessmen is very crucial for the sustainable growth of the oil and gas sector. Businessmen as suppliers of goods and services to the gas sector and citizens for the supply of labor, security of infrastructures and ownership of decisions reached regarding natural gas. One participant among many posited “...the participation of local firms and citizens in the gas is the basic decision to be taken in order to realize sustainable development of Tanzania”. Another Participant cited that “...the government of Tanzania should allow citizen participation in the sector and in necessary decisions about the management of the resources in order increases their ownership, and keep them aware about every step taken and the possible benefits realized in the cause of extraction of oil and gas resources”. Another participant stated that “.... the government should make the public aware about all the stages natural gas sector development so that they can be able to track revenues obtained and the way they are used”. They accept that oil and gas is a national new wealth, which comes with higher expectations among them and the nation at large. Based on their knowledge, they believe that some decisions that the government takes, affect their life negative and or positive, then their involvement is important. In fact, it has been in the minds of Tanzanians that the discovery of natural gas may lead to the socio-economic development of the country, including creating employment, infrastructure development, and power generation in a very short period. However, the highest public expectation has been opposed by the fact that, oil and gas sector needs massive investment in Human Resources, Technology, Infrastructures, Training and Research (Mendes, Hall, Matos, & Silvestre, 2014), robust policies and institutions (Gulas, Downton, D'Souza, Hayden, & Walker, 2017), stakeholders involvement and

Leadership adequate preparedness (Moshi, 2014) to manage the resources, so need time and patience.

In this regard, participants posed that the public should be kept informed at each stage of the extraction and operation of the oil and gas sector, especially on what to expect in the short, medium and long-term periods to avoid confusion. One participant mentioned that “.... the government should clearly state the oil and gas sector purpose (clarity of purpose) to enable the public to know what to expect in each stage”. Another participant stated, “...institutions responsible for oil and gas management should win trust, manage public expectations by involving them, and provide feedback on significant decisions taken in the oil and gas sector. Consequently, participants advanced that the participation of businessmen and local firms in the supply and value chain promotes the growth of the gas sector, create employment and promote supply of local goods therefore promote economic development of the country. However, to engender their effective participation, the government and gas companies need to deliver capacity building programs in terms of capital, technical expertise, and awareness programs.

Similar results found in the literature where some scholars echoed that a well-informed public makes them aware of the rights to participate in important decisions concerning necessary issues surrounding natural gas management. As, such it enables decision-makers to make the right choices and accommodate citizens' concerns into the broader planning strategies (Schwarte, 2008). Also, citizen participation in the oil and gas sector guarantees peace and security so enables international companies operate in a very harmonious environment (Abdulai, 2013).

**Enhance transparency and accountability mechanisms in the gas sector**

Seventy-five (75) participants as shown on table12 listed enhancing transparency and accountability mechanisms in the gas sector as feasible for harnessing natural gas resources for sustainable development of Tanzania.

Table 12: Enhance Transparency and accountability mechanism in the gas sector

<i>Age of Respondents</i>	<i>n</i>	<i>Percentage</i>	<i>Sex of Respondents</i>	
			<i>Male</i>	<i>Female</i>
20-29	6	8	4	2
30-39	23	31	14	9
40-49	19	25	9	10
50-59	17	23	10	7
60-69	10	13	6	4

<b>Total</b>	<b>75</b>	<b>100</b>	<b>43</b>	<b>32</b>
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Table 12 indicates that among 75 participants, 6(8%) participants were 20-29 years, 28(31%) were 30-39 years, 9(25%) were 40-49 years, 17(23%) were 50-59 years, and 10(13%) participants 60-69 years. However, 43(57%) participants were male, and 32(43%) were female. The overall results suggest that it is very important to enhance accountability and transparency in the gas sector in order to ensure proper management of the resources for the long-term benefits of Tanzanian. One participant indicates "...transparency and accountability is a requirement for the management of natural and gas resource". Participants consider that making natural gas revenues, contracts and negotiations between the government and the multinational companies open and transparent as something crucial the government should emphasize in order to realize long-term benefits of the resources. They commented that transparency and accountability, especially in contracts and revenues obtained from the extraction of oil and gas be made public and be accounted for. Likewise, participants believe that once every deal entered is transparent and revenue received is accounted for, will promote citizen trust and support. Another participant considers that "Transparency and Accountability is an important element in the decision chain, it is a cure for mismanagement of natural gas revenues and corruption". Majority participants hope that transparency is a fundamental aspect for ensuring natural gas resources are managed in the public interest. However, though there may exist feelings that perhaps it may be very difficult to monitor true resource revenues, and even harder due to often-pervasive corruption problems. Participants stated that there must be transparent mechanisms imposed to ensure that governments get the share of revenues they deserve. Indeed, participants believe that adopting transparent negotiation processes, auction extraction rights, put strong transparency arrangements for revenue management in place, and set up proper procedures to allocate extraction rights and binding agreements about tax rates, may bring extended benefits of

the resources to the nation. Consequently, one participant considered strengthening Beneficial Ownership Transparency as significant aspect to be included in ensuring transparency of all processes of extracting natural gas resources. According to (Klein, 2017; Streiff & Beduin, 2017), Beneficial ownership Transparency entails instituting appropriate safeguards to prevent misuse of corporations or other legal entities from tax evasion, fraud, and corruption. The participant mentioned that.... "Owners of companies including the government-owned entities and multinational oil and gas companies must periodically and openly publish and report beneficial ownership detailing the revenues, assets, employment, revenues, profits and taxes paid"

Similar views were found in the literature. (Abdulai, 2013) suggests that oil and gas revenue transparency and accountability is a pre-requisite for ensuring sustainable development. Indeed, it is a significant step towards winning citizens trust and confidence. Also, (Glada Lahn, Mitchell, Myers, & Stevens, 2007; Hawrysz & Maj, 2017) points clearly that transparency and accountability have a great contribution to sustainable development. Similarly, (Moshi, 2014) suggests that for the sustainability purposes, all extraction activities including negotiations, contracting and signing of an agreement between Tanzania and multinational companies should be transparent. In addition, the disclosure of information about extracting volumes, selling items and revenues generated out of it is significant in ensuring that natural gas contributes enormously to the economic development of Tanzania.

**Ensure constant supply of natural gas for domestic and industrial consumption**

Sixteen (16) participants as shown in table 13 stated enhancing transparency and accountability mechanisms in the gas sector as feasible for harnessing natural gas resources for sustainable development of Tanzania.

Table 13: Ensure constant supply of natural gas for domestic and industrial consumption

Age of Respondents	n	Percentage	Sex of Respondents	
			Male	Female
20-29	1	6	1	-
30-39	3	19	2	1
40-49	5	31	4	1
50-59	4	25	2	2
60-69	3	19	2	1
<b>Total</b>	<b>16</b>	<b>100</b>	<b>11</b>	<b>5</b>

Table 13 indicates that among 16 participants, 1(6%) participants were 20-29 years, 3(19%) were 30-39 years, 5(31%) were 40-49 years, 4(25%) were 50-59 years, and

3(19%) participants 60-69 years. However, 11(69%) participants were male, and 5(31%) were female. The overall results indicate an even distribution of participant's

responses across ages and adequate representation among male and female.

For sustainability purposes, oil and gas resources utilized (consumed) both for domestic and industrial use. It is clear that when oil and gas resources utilized in huge volume it may encourage the massive production and supply and finally stimulate industrial growth. The majority of participants claimed that the utilization of oil and gas resources for domestic and industrial use is imperative for the sustainability of oil and gas. They believe that, utilization of oil and gas may reduce the cost of living and promote sustainable development. They cited, for example, that if oil and gas utilized (consumed) in large volume industries may reduce the cost of production and prices of their products will go down. At the same place, participants insisted effective utilization of natural gas for power supply to stimulate industrial growth and attract potential investors in

different sectors of the economy. One participant posited that “...to realize sustainable development out of natural gas exploitation, natural gas has to be consumed in large quantity internally for domestic and industrial use and surplus be exported to the external market so as to generate huge revenues to support social services and economic development project”. Another participant posited, “...local firms and the private sector should participate in the supply of natural gas in large quantity so as to generate local employment”

**Enhance Accountability for Decision Making and Performance**

Forty-one (41) participants listed enhance accountability for decision-making and performance in the gas sector as feasible for harnessing natural gas resources for sustainable development of Tanzania.

Table 14: Enhance Accountability for Decision Making and Performance

Age of Respondents	n	Percentage	Sex of Respondents	
			Male	Female
20-29	2	5	2	-
30-39	13	32	9	4
40-49	14	34	8	6
50-59	7	17	5	2
60-69	5	12	5	-
<b>Total</b>	<b>41</b>	<b>100</b>	<b>29</b>	<b>12</b>

Table 14 indicates that among 41 participants,2(5%) participants were 20-29 years, 13(32%) were 30-39 years, 14(34%) were 40-49 years, 7(17%) were 50-59 years, 5(12%) participants 60-69 years, and . However, 29(71%) participants were male, and 12(29%) were female. The overall results indicate participants concern on enhancing accountability for decision making as a very important factor for enhancing sustainable development Tanzania. As one participant wrote “...for sustainability purpose, stern punishments should be given to all people involved in the mismanagement of natural gas fund”. Another participant posted that “...Public servants should be held responsible for entering contracts which are not in the public interest”. Also, another participant posted that “.... the government should set performance targets and standards to all people responsible for managing natural gas resources to increase accountability for decision making and performance”. Besides, it is evident that the gas sector requires the involvement of different decisions by public servants or any organizations entrusted. In the pursuit of their responsibilities, public office holders expected to display the highest performance standards that are beneficial to the country, and so make decisions that are in the public interest. In that case, they should be accountable for any decision

taken and or any performance realized. Government decisions should, therefore, made to subject individuals, bodies, and institutions responsible for managing natural gas resources to public or external scrutiny as this may enable the resources have a significant contribution to the national development.

Moreover, both closed ended and open-ended results have the implication of adequate decisions to be made by the government of Tanzania in the proper management of the natural gas resources for long-term social and economic development. The overall results are imperative in ensuring that revenues obtained from natural gas are used effectively to support social and economic development projects. Results from both methods, also, indicate that in order to accelerate social and economic development, natural gas should be managed effectively. In the same way, no one should plunder revenues derived from natural gas resources rather all revenues should be accounted for and wisely use to further long-term development projects and for an accelerated transition out of poverty. Indeed, the results suggest that sustainable development of Tanzania largely depends on fundamental decision chains enshrined in the proper management and governance of natural gas resources.

## 5. CONCLUSIONS

Natural gas resources have the potential to spur economies when properly managed. In Tanzanian case, management of natural gas in Tanzania requires consideration of a broad range of transformative decisions for enhanced sustainable development. The core to ensured sustainable development of the country may largely depend on proper management of natural resources revenues by ensuring that they are spent on viable social and economic activities. Economic decision chains including planning and development and governance of the entire value of natural gas is critically important. Tanzania may, therefore, benefit from natural gas wealth, by ensuring participation of the governments and other stakeholders (citizens, International companies, political parties, civil societies, and private sector) in making a broad range of decision chains. Subsequently, each decision chain may require the governments to consider complex options and trade-offs and devise strategies to implement the policy choices that may lead to sustainable development and growth of the country. In fact, the nature of decision chains tails the extractive value chain from exploration, development, promotion and distribution processes. In this case, the government must take cognizance of the role of the natural gas resources in social economic development of the country by capturing, maximizing value and regulate the industry to further sustainable development projects. Finally, government adequate preparedness in terms of proper resource planning and development decisions, fiscal management, accountability and transparency, well-balanced prioritization, multiple and strategic stakeholders' involvement, effective revenue approaches and robust policies and its implementation strategies, can create a conducive environment for harnessing the resources for sustainable development of Tanzania. However, without proper decision chains, robust policies, strong management, poor planning and development strategies of natural resources, plundering of revenues, limited involvement of strategic stakeholders, Good Governance and strong oversight institutions, natural resources paradoxically may undermine development.

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