Exploring the Influence of the Social-Ecological System Condition Around Oilfields on the Economic Outcome of Nigeria's Natural Resource-Dependent Economy



Nosayaba Odemwingie Oka

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Abstract

Exploring natural resource-dependent contexts' social-economic problems through the social-ecological systems framework provides valuable sets of variables for understanding the outcome of the social interaction during resource extraction. In the Nigerian context, three property rights regulate the common-pool resources system around its oilfields. However, once oil resource is discovered in any community, natural resource management centralises the interactions within the social-ecological system. Previous studies applying GDP datasets to interpret the Nigerian social-economic problems may have overlooked the natural resource management challenges in the oil resource mining contexts. This thesis traces the history of natural resource management evolution and structuring to understand governance system design, capability, and enforcement impact on social-economic systems in Nigeria, starting from the oil mining contexts. Exploring the research problem through the Pragmatist's philosophical standpoint, this study designed a sequential mixed-methods approach that administered two sets of survey interviews in communities around the Niger Delta to interrogate multiple real-life human experiences. Qualitative evidence is reinforced by questionnaire evidence generated from randomly selected sample population across from a larger geography within and outside the interview survey setting. The different survey evidences are evaluated sequentially through qualitative thematic analysis, complemented and corroborated by quantitative descriptive and inferential statistics.

Data analysis results suggest that competing operational property rights dominated by the centralised natural resource management system experience its own capability and enforcement challenges. Thus, while the oil mining activities impose oil spills and gas flaring contaminants on the social-ecological system in the survey setting, the natural resource management approach is widely perceived to be unable to fully enforce its regulations for non-oil related natural resource values impact sustenance and livelihood sources because of the unpredictability of the informal and formal institutions administering the natural resource management system. This thesis provides evidence suggesting the trade-off of non-oil-related natural resource system values discovered social-economic impact on small-scale farming, fishing, and food processing, which threatens the food production value chain food shortages, inflation, unemployment and poverty with spill over to the Nigerian economic systems. Accordingly, from the often-overlooked economic effects of social-ecological system values erosion in natural resource-dependent contexts, this study has demonstrated that the institutional weaknesses underlying the social-economic problems in social-ecological systems around oilfields contexts are rooted in the ineffectiveness level of the governance system capability and enforcement.

Dedication

To my late Dad, Mr Sylvester O. Oka who is not available to see your little son that you enrolled in different grades of schools complete a PhD Research. You deserve much than I was able to give. Thank you so much!

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Author's declaration

I declare that the work in this thesis was carried out in accordance the regulations of the University of Gloucestershire, and is original work except where indicated by specific references in the text. No part of this thesis has been submitted as part of any other education institution in the United Kingdom or overseas. All views expressed in the thesis are those of the author and in no way represent those of the University. Thesis word count exclude glossary, table of content, bibliography and appendices.

Signed: Nosayaba Odemwingie Oka Date: 12 September, 2024

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Glossary

A note on terminology

DPR: Department of Petroleum Resources

GDP: Gross Domestic Products

IUCN: International Union for Conservation of Nature

IPBES: Intergovernmental Science-Policy Platform for Biodiversity and Ecosystem Services

NBS: National Bureau of Statistics

NEITI: Nigeria Extractive Industry Transparency Initiative

OPEC: Organisation of Petroleum Exporting Country

UNDP: United Nationals Development Programme

UNEP: United Nations Environmental Programme

USAID: United State Agency for International Development

Aesthetics Beauty: This description refers to the natural configuration of the natural resource system that makes it look artistic, appealing and attractive for human engagement.

A framework: In research frameworks helps organise thinking by identifying key variables and outlining their relationships. In this social-ecological system theory, the framework provide structure on how variables are mapped and indicators selected for investigating hypothesis or theory.

A common-pool resource is a natural resource geography or humanly-constructed system with biodiversity ecological system that is accessible to multiple individuals, social groups, and institutions based on applicable social prescriptions or operational rules. The management of a common-resource pool is characterised by open access, constitutional

regulation, private ownership, collective action, or combinations of property rights (Ostrom, 1990, 2005).

Diagnostic framework represents the organisation of variables that is applied for mapping interactions of variables, identifying indicators to guide field survey exercise and analysis of evidence to resolve the problematic situation under study

Institution Structuring refers to the organization of interrelated rules, values, norms and regulations within a defined society or geography either as an entity or system for shaping behaviour, decision-making processes and social stability.

Intrinsic Value: This refers to specific usefulness and value attributed to the natural resource system by individual or social groups, independent other values and benefits attached to it by other parties.

Governance System: For clarity governance system comprise different autonomous, but interdependent systems and subsystems of rules, regulations and policies underpinning overlapping institution structures and system guiding natural resource system extraction and transformation and social-ecological system safeguard.

Oil Pollution: This is described as the effluence of hydrocarbon substance on the natural resource system from oil mining that generate negative effect for the social-ecological system safeguard and productivity.

Polycentric System is a setting with set of interrelated rules and institutions regulating social-ecological system interactions at different level and scales for towards achieving defined outcome. (see Ostrom, 1990)

Political arrangement: A political arrangement is the broad and organized system of established pattern of relationships for coordinating human wellbeing, functioning and administrative expediency.

Social-political relationship refers to the interaction, coordination and power dynamics between individuals, groups, communities, institutions and political arrangements within and between contexts for regulating behaviours, decision-making process and social stability.

Social contract refers to symbolic agreement by which individuals and groups in a social-political system understand, consents and subscribe prescribed practices, rules and legitimatized institutions for predefined behaviours and social stability

A theory is a predictive description of testable relationships about a phenomenon that is applicable for guiding the gathering evidence to prove or refute it.

Variable: A variable refers to the description, identification and categorization of measurable factors represented in varying quantity and quality that were subjectively or objectively manipulated or controlled to generate evidence for analysis. The variable that is dependent in the study is social-economic outcome) on the independent variable, social-ecological system condition.

Chapter One

The Research Context and Thesis Structure

1.1 Introduction

This chapter provides the background knowledge of the research phenomenon using existing interpretations to explain the Nigeria social-economic problem. Following the perspective of previous findings, this study categorises the phenomenon into economic, social, and ecological dimensions to guide the data analysis process. Then it explores the literature to identify gaps in studies that overlook the social-ecological system dimension of the research phenomenon. For example, although this research agrees that effective institutions can control the mismatch between natural resource system management and the social-economic outcome, it proposes to interrogate the aspect of institutions that underlie Nigeria's natural resource management as one of the objectives of this study. Also, the study explores the condition under which institutions are structured for design and enforcing governance systems for natural resource system management. Based on this theoretical assumption, the design of the research aim and objectives guide the exploration of the phenomenon. The chapter ends by providing an overview of how each chapter is structured to guide knowledge generation in this thesis document.

1.2 Background of Study

After 64 years of oil discovery in Nigeria, despite boasting of an estimated reservoir of about 37 billion barrels of crude oil and 183 trillion cubic feet of natural gas, with a peak daily crude oil production averaging 2 million barrels (OPEC, 2022); the social-economic reality has not measured up to expectations. For example, citing the inability to transform its key manufacturing and agricultural sectors to economic growth, Auty (1995) reported Nigeria’s negative growth rates and a 1980 debt portfolio exceeding US$30 billion. The National Bureau

of Statistics (NBS) (202) estimated the expansion of Nigeria's nation debt to USD$91.46 billion, aside the debt relief package of USD$18 billion granted to the country in 2005 (Okonjo-Iweala, 2007). This woeful economic performance persisted despite an estimated volume of about 34.9 billion barrels of crude oil that has been extracted from numerous oil wells mostly around the Niger Delta geographical area, that constituted 94 per cent of export earnings and 62 per cent of government revenues between 1970 and 2024 (Nigeria Economic and Group Plan (NEGP), 2017). Although, the economy grew to US$509 billion to become Africa's largest by Gross Domestic Product (GDP) in 2013 (World Bank, 2013). However, the GDP performance was recently estimated as USD$199, even though the economy performance grew 6.3 per cent between 2005 and 2015, before shrinking to -0.36 per cent, 2.1 per cent, and 2.2 per cent in the first, second, and third quarters of 2022 respectively (Nigeria Bureau of Statistics, 2023). Accordingly, World Bank (2020) reported that by global economic benchmarking indicators, Nigeria economic performance was far below the global average.

Beyond the economic performance scorecard, other social statistics suggest that the country's population is grappling with an estimated 133 million multidimensionally poor people (NBS, 2022). Also, from the country's 211.4 million population, 85 million are reportedly undernourished, 100 million lack access to safe water, 90 million lack access to electricity, and 60 million people rely on traditional biomass for cooking (UNFPA, 2021). Moreover, a recent study estimated that 31.8 million Nigerians currently face acute food insecurity (Budget Office, 2024). Besides, the infant mortality rate is reported to be estimated at 63 deaths per 1,000 live births, while the under-5 mortality rate is 102 deaths per 1,000 live births. The neonatal mortality rate is 34 deaths per 1000 live births. Child mortality is 42 deaths per 1,000 live births. This implies that about 1 in 10 children in Nigeria die before their 5th birthday (NBS, 2022). Additionally, the economic data reflects an unemployment rate

estimated at 33.3 per cent (representing 23.18 million people) in the fourth quarter of 2020 (NBS, 2021). Furthermore, studies reporting incidences of security concerns around oilfields from property rights and social-political conflicts that overflow to other parts of the economy (Mahler, 2011; Martinez-Allier, 2014).

From the environmental perspective, an estimated 817 million standard cubic feet (mmscf) of gas was reportedly flared between 2018 and 2020 (NEITI, 2021). Also, the National Oil Spill Detection and Response Agency's (NOSDRA) monitoring online platform estimated 13,091 spill events totalling about 692,761 barrels between 2006 and March 2020. Additionally, the DPR statistical bulletin (2018) reported that 168,032 barrels of crude oil were spilt between 2010 and 2018. Furthermore, Amnesty (2014, p. 11) has referenced the Niger Delta geography of Nigeria as a 'polluted and dangerous environment'. Despite these natural resource management reported challenges emanating from oil mining activities without commensurate social-economic development, recent studies commissioned by multilateral agencies and governments identified oil spillage, gas flaring, and other social-ecological complications from oil mining activities are linked to environmental condition, health and in cases economic concerns around the Niger Delta geography (UNDP, 2006; UNEP, 2011; Sentamu et al., 2023). Nevertheless, findings from other natural-resource dependent economies have suggested the persistent poor performance of countries relying revenues from natural resources export since the 1960s (Auty and Gelb, 2001). Besides, insight from Work Bank, (2003) linked the prioritisation of oil resources exploration over the agricultural sector in natural resource management have impacted sustenance and livelihood sources. Whereas varieties of statistics suggest the mismatch between social-economic outcome and natural resource management in natural resource-dependent contexts, this study propose to

explore the social-economic problems based on the interrelations between oil mining and agricultural activities across the social-ecological system landscape in Nigeria's oilfields.

1.2.1 Existing Interpretations of the Research Phenomenon

From exploring available statistics on the Nigerian social-economic phenomenon, several studies have generated different interpretations on the Nigerian phenomenon. For example, Auty (1993) alluded to Nigeria's inability to transform its natural resources into social-economic development as a 'resource curse'. This conclusion was corroborated by Carmignani (2010), but argued that the reason for the resource curse is the mismatch between governance and institutional capability, and supported by Ross (2013) and Morrison (2013). However, Bablawei and Luciano (1987) studying the oil dependent economies in the middle east region referred to a similar natural resource management problem as rent-seeking. The rent-seeking mentality is a social function of a special group that seeks the reward from resource endowment without actively contributing to economic production. Likewise, Tornell (1999) slightly differed on the rent-seeking theory and suggested that nature can only be a gift when its generated economic rents are efficiently managed for social-economic development. Besides, Collier and Goderis (2012) submitted that resource windfall and economic growth, in the absence of capable institutions, will only trigger an increase in rent-seeking. But, Acemoglu and Robinson (2008) underscored that where the structure and system of governance supports are premeditated, methodical, and unbiased, rent-seeking challenges can be controlled. Meanwhile, Corden and Neary (1982) from exploring the crisis of the Netherlands' natural resource-dependent economy, coined the natural resource management challenge as 'Dutch disease' to explain the influence of foreign exchange inflow that overvalues the country's currency value to the detriment of prices of locally produced goods and services. The Dutch disease theory was supported by Mikesell (1997) and Spatafora

(1995). Nevertheless, Kaznacheev (2013) suggested future studies should rise beyond 'curses' and 'diseases' when interpreting the economic problems of natural resource-dependent contexts.

These studies interpreting resource curse, Dutch disease, and rent-seeking theories may have their own empirical value in natural resource-dependent contexts. But these theories may be unable understand the factors underpinning and overlapping institutional structures and systems for design rules (institutions) for natural resource management, the capability of such institutions or under what condition the resource management regulations are enforced (see Ross 2013). For example, Auty (2017), in studying sugar-rich Mauritius and oil-rich Trinidad and Tobago, added that in contexts exposed to the adverse effect of oil price volatility and other fiscal complications, effective institutions can easily address the effects of external shocks for economic stability. However, Kaufmann et al. (2005) and Allellaneda (2010) argued that limited knowledge of good governance burdens theoretical propositions with inadequate analytical tools to support the oil resource negative effect under certain conditions. But, West et al., (2022) in assessing deforestation risk through agricultural commodity supply chains discovered the problem of exporting ecological system deficit because of domestic agricultural commodities production for external actors. Thus, corroborating Halvor's (2006) debate on how institutions contribute to economic performance is multidimensional. However, the question of whether the institutions are effective enough to transform natural resource systems for social-economic development from the perspective of policy actors is one dimension or provide social-ecological system stewardship for crosscutting and bottom-up allocation of natural resource values is another dimension.

1.2.2 Rationale for this Study

The Nigeria's economic problem so far theoretically explicate a complex blend of multiple interrelated sub-systems of economic, population and environmental challenges, interplaying multidimensionally. Moreover, theoretical insights from exploring the different theories interpreting the natural resource management challenges in resource-dependent suggest that the different perspective about the Nigerian social-economic problem cannot be overlooked. However, referencing the Nigerian social-economic phenomenon from GDP performance datasets using secondary datasets may be too narrow capture the broad and deep consequences of natural resource management that cut across different social hierarchies, system and demography as well as many geographical contexts with diverse property rights and social-cultural ideologies. For example, social-economic outcomes in a natural resource-dependent context can be facilitated by a diversity of factors that may be too complex for GDP dataset to evaluate (Dasgupta, 1995). Additionally, previous studies overlook the complex factors underlying the natural resource management, and the consequences on SES that may threaten other attributable values outside of oil mining to it. Yet, many studies exploring natural resource-dependent economic problems have been mostly focused on the triumphalism of effective institutions in natural resource management linkages to economic development, without exploring the political arrangements influence on institutions structuring. Yet, institutions, either by natural evolution or social-political influenced design are likely to generate their own consequences on the ecological system with broad impacts on human sustenance, livelihood and other biodiverse stock of plants and animal species.

Considering the review of whatever theories previous studies might have attempted to interpret natural resource-dependent contexts challenge without interrogating the

different factors influencing natural resource management institutions, this study argues that without examining under what conditions and the institutions system and structures have evolved and are enforced, their interpretations may only be one-sided. Therefore, this study suggests that because distinctive social-economic contexts are likely to configure their institutions with specific norms, values, and ideologies during the processes of institution structuring, linking effective institutions to economic outcomes is misleading without determining the factors that defines its effectiveness. For example, sustainable social-ecological systems functioning can generate economic value support for human sustenance, livelihoods, and social-economic outcomes (National Research Council, 2005). Besides, Commoner's (2020) first rule of ecology states that everything is interconnected, even though some connections matter more than others. This understanding may provide more reasons to question the persistency of institutions, the enforcement of its social contract in natural resource management context and influence on household income and local communities economic condition. Therefore, exploring the research problem may require the interrogation of both the vertical and horizontal dimensions of the multiple convergences between natural resource management and social-economic outcomes.

While there seem to be knowledge gaps on the linkages of effective institutions to economic development in natural resource-dependent context, this study intends to explore the evolution of institution structures and systems, their capabilities, and the enforcement level of operational rules in Nigeria for interpreting the research problem. Also, this study seeks to interrogating the social perception to generate primary evidence on the relationship of what type of development is proposed by natural resource management and the social reality in the social-ecological system where oilfields are located. From the primary evidence, study can be able to interpreted the impact of natural resource management approach on

household incomes, micro-community economic development outcome and its overflow to the natural resource system. Expectedly, research finding from data analysis can facilitate the generation of a comprehensive knowledge on the economic phenomenon in natural resources-dependent contexts and generate insights that empirical science and policy actors can apply for natural resource management and cross cutting social-economic outcomes. By this approach, it examines the multiple interactions in the social-ecological system during natural resource system extraction and transformation between the social actors for evidence-based research results and findings.

1.2.3 The Philosophical Standpoint

Different literatures have categorised ontological perspectives for studying research problems. As foundational for this social research study, the philosophical standpoint consideration is discussed based on the beliefs and philosophical assumptions underlying the proposed research exercise (Creswell & Poth, 2017). For instance, ontology is claims, assumptions and description about what exists that are made about the nature of social reality (Blaikie, 2000). Also, Crotty (2003, p. 10) defines ontology as the “study of being." Thus, ontology represent the reality from which research study seeks to explore the research problem. Saunders et al. (2019) classified five key commonly used ontologies for research studies as positivism, interpretivism, critical realism, postmodernism, and pragmatism. This categorisation of sphere of being allows for careful consideration and adoption of the nature of reality for exploring a research phenomenon. Thus, for a research study exploring social-economic problem from the social-ecological system perspective, it can be suggested that the concept of the SES can be experienced and interacted with by humans in everyday real-life reality. Considering that the study involves the exploration of the social reality from practical real-life experiences that evolve through human repetitive interactions, discussion, and

debate with the natural ecology, the study adopts Pragmatist's Instrumentalism as the philosophical standpoint for this study (Dewey, 1938).

1.3 **Pragmatist's Epistemology of Study**

The pragmatist's epistemology is descriptively rooted in exploring multiples experiences and perceptions from human socialisation with ecosystem. Accordingly, as an open, explorative, and progressive philosophical standpoint, this knowledge confirmation exercise blends theoretical analysis with interrogating different social perceptions from practical experiences of interacting with the SES around oilfields. This implies that because humans are embedded in their natural habitats, experiencing and adapting in sourcing sustenance and livelihoods, the outcome of their lived experiential knowledge can symptomise the condition of their contextual ecological system (Ostrom, 2007). Although the generated evidence from the empirical interrogation may be subjective. However, it will expectedly be processed through systematic analysis, interconnected with existing theories and social enquiry that generate primary evidences to interpret the research problem. This implies that admissible knowledge will be catalysed from surveying multiple experiences of human socialisation within the social-ecological contexts to generate evidence for analysis. However, orthodox scientific experiment has cautioned against Pragmatist epistemology (Mumford, 1926; Popper, 2005). Nevertheless, it may be misleading for traditional philosophies to criticise an interdisciplinary study that applies a philosophical standpoint that best serve the purpose of understanding social phenomena from exploring human experiences. Besides, Kuhn (1970) submitted that pragmatism denotes a conceptual framework for examining problem from the perspective of a common set of belief, values and assumption. Additionally, this pragmatist's study submits to the empirical rigour, scale, depth, and richness by preferring mixed-method exploration of social perspective to control the

elements of subjectivity with objectivity. Moreover, the empirical process considers Lincoln and Guba's (1985) guidelines for generating knowledge.

1.4 Research Aim

This study generate knowledge from "understanding Nigeria's natural resource-dependent social-economic problems from the perspective of social-ecological system around oilfields."

1.5 Research Objectives

Exploring the research problem has identified many unresolved issues about the social-economic outcome in natural resource-dependent contexts, where natural resources are extracted based on the effectiveness of institutions. Therefore, the main research objectives to help achieve the research aim are:

1. To understand the relationships between oil mining activities and other natural resource system values around the oilfields for explaining Nigeria's social-economic problem.
2. To explore the historical and social-political foundations that have shaped the evolution and structure of natural resource management institutions in Nigeria.
3. To explore how the effectiveness of natural resource management institutions can be evaluated from the perspective of the social-ecological systems around oilfields.
4. To conceptualise and design a context-specific theoretical framework for investigating natural resource system impact on sustenance and livelihood sources in the social-ecological system around oilfields.
5. Building on research objectives 2, 3 and 4, to design and apply a purposive mixed-methods diagnostic framework for collecting three layers of field survey evidence to connects the research problem with research findings.

6. To conductive a qualitative analysis on the evidence gathered from survey interviews for interpreting the research results and generating insight for designing the survey questionnaire.
7. Conduct a quantitative analysis of survey questionnaire evidence to generate results and findings for meeting Objective 6, as a preliminary understanding of the research problem.
8. To complete Objective 5, integrate and compare the data analysis results and findings from both phases of data analysis to comprehensively explicate relationships between the natural resource management and the social-economic problem.

1.6 Thesis Structure and Content

This thesis consists of ten chapters. The first chapter problematise the research argument, before exploring the different bodies of literature interpreting the Nigerian social-economic phenomenon to generate research aim, and objectives for guiding the exploration of the research problem. The second chapter explores social-political arrangements influence on institution structuring, defines the concept of institution, explores the institution theory, and differentiates the types of institutions before exploring the historical episodes that influenced the evolution of modern-day institutions for governance system design and natural resource management in Nigeria. The third chapter explores factors that influences the effectiveness of institutions, before tracing linkages of institutions to economic development. To examine natural resource management institutions to the social-economic performance of the Nigerian economy, it explores the suitability of the Institution Analysis and Development (IAD) framework (Ostrom, 2007) for developing a theoretical framework. However, it provides the rational for adopting the SES theory (McGinnis and Ostrom, 2014) for the theoretical framework design. The fourth chapter broadly explores, describes and maps the SES theory variables, before identifying and selecting indicators to guide the design

of field survey diagnostic framework. Guided by the SES framework, the fifth chapter describes the research strategy, the methodological, and survey technique, evidence analysis approaches for generating results and research findings. The sixth- and seventh chapters analyse the qualitative and quantitative field survey evidence respectively, and present the research results and findings accordingly. The eighth chapter integrates the findings from the different data analyses Chapters (6 and 7) for interpretation. The ninth chapter discusses the findings and contextualises the interpretation to the place of study and its outcome on the research phenomenon. The tenth chapter concludes the study and illustrates its contribution to knowledge and practice, identifies areas for study and the limitations of study.

1.6.1 Chapter Two Literature Review

In achieving the research objective, "to explore the historical and social-political foundations that have shaped the evolution and structure of natural resource management institutions in Nigeria" (Objective 2); this study defines the conception of institution, explores the institution theory and differentiate the type of institutions. Also, it clarifies the distinctiveness of rules and norms within societies that underlie institution evolution and structuring. Then, to concretise the rationale for relating the reason problem to institution challenges, it distinguishes between different categories of institutions and the factors influencing them. It further explores the influence of social-political history from pre-colonial Nigeria to understand the evolution and restructuring of post-colonial institutions, social contract mediation and modern-day natural resource natural management institutions. The chapter identifying and synthesising different literatures on institution restructuring is to trace theoretical insights on the relationship between natural resource management and social-economic outcome in the next chapter.

1.6.2 Chapter Three Literature Review

To achieve the research objective of exploring "the effectiveness of natural resource management institutions linkages to social-economic outcome can be evaluated from the perspective of the social-ecological systems around oilfields" (Objective 3); this chapter explores natural resource management contribution to social-economic outcomes. Then, it provides supplementary insight by exploring factors contributing to effectiveness of institutions by identifying governance system capability and enforcement in natural resource management. The more Nigeria's natural resource-dependent economic problem is theoretically explored, the more the rationale for exploring the linkages between sustenance and livelihood sources around the SES to the social-economic complications is justified. This insight provided more reasons to examine the persistency of institutions, the enforcement of its social contract in natural resource management context and influence on household income and local communities economic condition. Although, the Institutions Action and Development theory (2007) was considered for the study, but considering the large number of variables identified during problematization suggest the feedback between historical and present factors underlying the natural resource management problem. However, McGinnis and Ostrom's (2014) SESF provided a wide variety of variables for the different SES components, developing a diagnostic framework to explore the specificities and the contrasting scales of contexts that are important to the study. Adopting the SES theory for exploring the research problem depicting an inefficient natural resource system management was to design a diagnostic framework that rises beyond a simplistic explanation for overtly complexities associated with the problematic situation.

1.6.3 Chapter Four – Theoretical Chapter (SES Framework)

From rationalising the social-ecological system framework as an empirical tool to guide diagnostic SES inquiry, the chapter describes a clear and coherent organisational structure for a comprehensive coverage of a wide range of social, ecological and economic dimensions to support theory building and testing. The McGinnis and Ostrom (2014) theory, clarified by Esptein et al, (2013), Hinkle (2014), Partelow (2017) and Nagel and Partelow (2022) to advance the framework for interdisciplinary and multimethod diagnostic inquiry, by identifying, describing and mapping the SES first and second tiers variables for field survey exercise. The process of mapping the SES variables suggested the consideration of new variables to supplement the canonical SESF variables to provide a broader latitude that eases context-specific of exploration of the deductively identified dimensions of the research problem. Expectedly, modifying the SES framework (SESF) variables and identifying indicators for operationalisation will be empirically sufficient to track and evaluate the repetitive real-life experiences in the survey contexts response to Objective 4. Although, the SESF framework served the purpose of the research strategy, but the emergent themes from data analysis of the survey evidence during thematic analysis required the inductive identification of new indicators that has now been suggested as new variables for tracking interactions in the context. Moreover, some of the survey evidence were in the qualitative segment were difficult to measure in the quantitatively without representative indicators the true unit of comparison in the study.

1.6.4 Chapter Five Methodology

This chapter presents the philosophical position and its rationale for the adoption of the pragmatist's instrumentalism philosophy (Dewey, 1938). Also, by describing the linkages between the philosophical, and epistemological, the study clarifies its methodological choice

in response to Objective 5. Thus, the social-ecological system framework is applied to guide the design of mixed-methods diagnostic framework that sequentially administers three survey instruments for the field survey evidence within SES around oilfields (McGinnis and Ostrom, 2014; Creswell et al., 2017). Purposive and snowball sampling are applied to collect the qualitative evidence, and random sampling is applied to collect the quantitative evidence (Agrawal, 2003; Tashokkori and Teddlie, 2003). Also, a sequential data analysis approach is proposed for generating results and research findings. This process of problematising the phenomenon, theoretically analysing previous studies, and operationalising the SESF in the survey setting, supports this study to build on and contribute knowledge on the research problem, SES framework, mixed-methods diagnostic framework design, application, and qualitative data analysis.

1.6.5 Chapter Six Qualitative Data Analysis

This chapter applies the thematic data analysis technique to systematically order and sort the field survey evidence as a preliminary response to Objective 6. As a qualitative study, the qualitative data analysis of the first and second phase semi-structured interviews evidence (in one analysis), generates insights for survey questionnaire design. The data analysis segment starts from survey interview recording transcription into text through iterative listening to clean-up evidence field survey exercise reflexivity, and code dictionary design in preparation for coding exercise using Nvivo 20. The code dictionary that consists of category names and definitions for assigning codes guided by McGinnis and Ostrom (2014) and Herzog et al. (2020) studies was to ensure coding accuracy and logical consistency for comparability with existing SESF studies exploring common-pool resource problem. Then the data analysis proceeded to identify themes to map findings underpinned through illustration of data analysis results in tables and visualisation. The rich and in-depth survey evidence data

analysis result verbatim reporting tabulation and visualisation demonstrates how the themes supporting the research findings are generated. Also, the data analysis process indicates that a structured analysis of field survey evidence can generate results that re-echo the respondent's perspectives.

1.6.6 Chapter Seven Quantitative Analysis

Chapter 7 quantitatively analysis survey evidences by applying descriptive and inferential statistics in response to Objective 6. Descriptive statistics analyse evidence that is presented in tabulated format and bar chart to report the survey evidence. Also, selected pieces of survey evidence are hypothesised for evaluating the linkages of household income and micro-community economic condition the national economic outcome for the purpose of making valid claims. The inferential statistics using Pearson Chi-Square and Spearman Correlation evaluates the hypothesis to text for statistical association and significance between the selected categorical attributes. The data analysis results concretise natural resource management impact on sustenance and livelihood sources contribution to household's income and micro-community economic condition levels, with a spill over on national economic condition. This quantitative analysis results and findings are applied to complement and corroborate the qualitative data analysis segment in Chapter 6 to provide analytical and statistical strength for findings generalisation.

1.6.7 Chapter Eight Integration of Data Analysis Results

This chapter combines the sequentially analysed data (qualitative analysis in Chapter 6 and the quantitative analysis in 7) for interpretation in response to Objective 8. The findings of this chapter bring together the findings from different epistemological perspectives for interpretation. Integrating findings from different data analysis segments provides an overall pattern of the findings and reveals the intersection of the social, ecological, and economic

dimensions to explain the research problem. Findings are illustrated in a tabular form according to the deductively identified and inductive emergent themes for systematic reviews of the relationships of each data analysis segment. This data interpretation approach illustrating the complementarity and corroboration approach justify the application of a sequential mixed-methods for exploring and explaining a complex social-ecological system problem.

1.6.8 Chapter Nine Discussion

The SES dimension of the Nigerian oil and gas-endowed and dependent economy has been empirically theorised, explored, and evaluated in Chapters 6 and 7 and interpreted in Chapter 8. This chapter, in response to the research aim, discusses the findings generated from Chapter 8 and links the findings to the background of the study, theories, and established contextual practice. Building on this knowledge, the conceptual contributions are applied to improve the application of the SES theory to explain the relationships between effective institutions and social-economic outcomes based on the level of governance system enforcement. From exploring the SES interaction in the oil mining context, the study interprets the different effects of natural resource management influence on human sustenance, livelihood sources and households' income, the economic condition at community level and national economic level to comprehensively explicate the social, ecological, governance and economic system factors interacting at multiple levels and scales to influence the research problem.

1.7 Chapter Summary

This chapter provides an overview of the whole thesis, providing the key ideas and insights in each chapter and the research contribution to knowledge. From exploring the previous studies to problematise the social-economic problems in Nigeria, the study adopts

interpretations linking the phenomenon to the persistency of ineffectiveness of natural resources management. To concretise the concept of institution effectiveness, this study explores the relationship between the evolution of natural resource management institutions contribution to governance system design, capability and enforcement of operational rule to regulate interactions with the social-ecological system near oilfields and the social-economic outcome. After exploring and explicating the social, ecological, and economic interrelationships at multiple levels and scales, the study adopts the social-ecological systems framework that draws heavily from conceptualising social-ecological systems with a high degree of interaction as a versatile empirical tool to examine the complex social-ecological complex problem. Thus, this study contributes to the institution and SES theories by designing and operationalising a SES diagnostic framework to interrogate the effectiveness natural resource management, sustenance and livelihood sources, household income and economic conditions in natural resource-dependent contexts. An important contribution of this study is applying the SESF to design a diagnostic mixed-methods framework to generate primary survey evidence from interrogating multiple social perspectives on natural resource management impact on the social-ecological system conditions and social-economic outcomes around the Niger Delta oilfields. Also, the results from sequential mixed-methods analysis demonstrate how integrative, interdisciplinary research that includes both qualitative and quantitative data can yield a broader and richer understanding of nested SES problems around oilfields. Although the research study data analysis segments generate findings that are revealing, many of the analysed survey evidence has never before been explored or mapped at this granular scale to understand natural resource management impact on social-economic system.

Chapter Two

The Historical and Social-Political Foundation Underpinning the Evolution and Structuring of Natural Resource Management Institutions in Nigeria

2.1 Introduction

To achieve the research objective of exploring "the historical and social-political foundations that have shaped the evolution and structure of natural resource management institutions in Nigeria" (Objective 2); this chapter explores social-political arrangements influence on institution structuring, defines institution, explores the institution theory, and differentiates informal and formal institutions and their interrelationship. Also, it clarifies the distinctiveness of rules and norms that underpin informal institutions and how it moderates social interactions. Then, it further explores the evolution of pre-colonial informal institutions into post-colonial formal institutions for modern-day institution for designing natural resource governance system. Then, it explores institutions and their contribution to social-economic outcomes. This process of exploring, identifying and synthesising intersecting institution theories provides theoretical insights on the factors underlying and influencing institution capability and enforcement for effective natural resource management in natural resource dependent contexts.

The institution theory has become very prominent in interpreting economic problems in different natural resource contexts. To situation the understanding, North (1990) and Ostrom (1990) described institutions as a shared set of rules guided by rules and norms designed to constrain and incentivise human repetitive interactions. To concretise the concept of institution effectiveness, this study explores the relationship between the evolution of institutions, governance system design, natural resource management, the social-ecological system stewardship near oilfields and the social-economic outcome. Typically, the social-

political institutions and systems are expected to design natural resource management institutions in the most efficient way for sustainable social-economic outcome for all social parties. However, local politics, social institutions, and collective action situations can become inherent political pressure points underlying institution design (Collier, 2010). Moreover, the question of whether institutions are fiscally centric, human development or natural resource systems sustainability-focused as a mechanism for natural resource extraction may be dependent on social contracts bargain between social-political arrangements (Agrawal, 2003). For example, Bebbington (2015) underscored that economic problems in the natural resource context are political rather than economic phenomena. But, if the governance system capability for transforming the resources into human wellbeing is no longer tenable, then the government basic functions of providing development may be in jeopardy (Robeyns, 2017). This suggests the dimension of social-political complications underlying social-contract bargain, institutional structuring and governance system capability and enforcement design for transforming natural resource systems can be deterministic of its social-economic outcome. However, interpreting effective institutions as deterministic for economic performance without considering underlying factors of institution evolution and structuring can shield the contributors to natural resource management ineffectiveness. Nevertheless, it is important to define institutions and contextualise its usage in this study.

2.2 Understanding the Term "Institutions", Its Definition and the Context of Usage in This Study.

This section describes the evolution of rules, clarifies the distinctiveness of rules within societies and how they regulate uncertainties within social interaction. Institutions are loosely described as socially constructed rules. However, there are classifications of rules for regulating human behaviour depending on their configuration and the strength of the

authority backing them (Hodgson, 2006). Although much of the theoretical review on institutional design, transmission, and development provide insights for clarifying the factors underlying the evolution of institutions in Nigeria. However, the theory rides on the concepts, and arguments that acknowledge the contribution of social processes to the evolution of institutions. For example, Commons (1936) underscored that institutions are natural rights and legal frameworks for constraining individual or group behaviours in collective action control, liberation, and expansion. Also, Hayek (2012) summarised institutions as social rules with embedded solutions for regulating social differences and engagements to navigate individual constitutional ignorance. Besides, North (1990, 201-202) clarified that institutions are a "set of rules, compliance procedures, moral and ethical behaviour; norms designed to constrain the behaviour of individuals in the interest of maximising wealth for social wellbeing." Additionally, Ostrom (2005) described institutions as shared ideas established by humans for interactions, guided by rules and norms accepted for daily operational instructions and imposing sanctions. But, institutions can also evolve when people have particular mental attitudes emanating from their beliefs (Searle, 2005). However, these definitions do not specify if institutions that evolve in the process of resolving specific problems, can also trigger their own consequences in multi-cultural and biodiversity contexts that will require institutions restructuring to resolve. Thus, the concept of institution may be more complex than presently theorized, which no singular definition can suffice.

Understood differently, institution is suggested to be prevalent in diverse cultural contexts where knowledge of social systems emerges to understand rules and norms for guiding social relationships (Alesina and Giuliano, 2015). Indeed, many scholars have interpreted institutions and explored their degree of contribution to economic development outcomes including North's revised definition (1991, 97) as "humanly devised constraints that

structure political, economic, and social interaction, consisting of informal constraints and formal rules." Also, Ostrom (2005) revised definition submits that “institutions are prescriptions that humans interacting within rule-structured situations use to organize all forms of repetitive interactions including different scales of households, neighbourhoods, economic systems, social, religious, public and private relationships. This suggest that institutions could be social ideals and instruments collectively bargained and accepted for regulating stable patterns of interaction. However, this study explores institutions on the basis of its systemic and structural foundation for natural resource management and how institutions as structure and system shapes social interaction within social-ecological systems.

To contextualise its usage in this social-ecological system study and avoid relying too much on disciplinary-specific definitions, an institution is described as systems of established rules that encapsulate common values, norms, and behaviours mutually adopted, and as structure that mediate and enforce rules for acceptable behaviours in social system. Also, rules can be mutually understood prescriptions underpinned by constraints and incentives to moderate human behaviour, while norms are social prescriptions from the implicit knowledge depending on social-cultural orientation or affiliation to guide human relationships and expectations (North, 1990; Agrawal, 2001). Having clarified institutions as a system of established rules that encapsulate common values, norms, and behaviours (McGinnis, 2016). Also, institutions can be differentiated as a system or structure, secondly as a formal and informal institution, and thirdly as an entity and concept. As a structure, an institution is a social scaffolding for incentivising, constraining, unifying, and shaping human behaviours, capacities and systems, to encourage reciprocity and facilitate exchange of views through trust building (Searle, 2005). From the perspective of McGinnis, (2016), structures define the ways in which social actors interconnected by shared interest are constructed into networks,

hierarchies, and other forms on interconnections. These structures shape the processes through which actors and system (as substructures) interact to generates outcomes at different levels, including tangible and non-tangible intrinsic values. However, institutional structures and sub-structures (decision points) jurisdiction mostly cover a range of collective action group when regulating interaction either for the extraction and consumption of natural resource resources common or other purposes. This suggests that institutions as systems or structures are self-enforcing and validating socially constructed standards and instrument that do not have to be universally acceptable. Nevertheless, whether institutions are universally acceptable or not, institutions as derivative from norms, values, and beliefs are prescriptive standards for regulating acceptable behaviour, expectations, aspirations, and social scaffolding to those subscribing to it.

Additionally, it is important to different between informal and formal institutions, and their scope of operations. Informal institutions are socially rules generated such as norms, values, and behaviours established as socially adopted prescriptive codes to guide human relationships and progress within a defined context. Formal institutions are defined rules and norms acceptable for the regulation of social behaviour but legislated into binding laws and legitimised by constitutional authority to guide human behaviour (Searle, 2005). For example, North (1981) categorised institutions into three levels, comprising constitutional rules, operational rules, and normative behavioural code. However, North (1990) and Hodgson (2006) agreed that any contradiction between formal institutions and informal institutions is merely a fallacy. Also, where formal institutions lack the support of informal institutions within nested structures, then they may be considered mere social declarations with societal scaffolding. According to them, formal institutions include laws, contracts, administrative rules, and procedures. But, informal institutions are implicit hereditary norms, values, and

beliefs that can equally bind social contract in informal transactions. This suggests that informal foundational institution structures can evolve into formal institutions from agelong ideological orientations into legal instruments that are considered just, efficient, or productive through social bargain and collection actions. This evolution is just as people are likely to obey norms, rules, and laws because of an equally deep-seated conviction that they are binding and progressive. Therefore, institutions can become complex interdependent phenomena for moderating stable patterns of human behaviour in social and economic interactions within contexts. However, the metamorphosis of informal rules and norms beyond social declarations of prescriptive codes into formal institutions using the legitimacy of legislative instruments may not suggest better efficiency for social-economic outcomes.

From another perspective, the term institution can represent both the entity and concept. As submitted by Hodgson (2006), when institutions usage relates to the formal entity, it represents groups of individuals bound by a common purpose to achieve set objectives, such as political parties, regulatory agencies; economic bodies (firms, trade unions, cooperatives); social bodies (churches, clubs, athletic associations); and educational bodies (schools, colleges, vocational training centres). This application of institution as an entity and structure are referred to the same thing (Hodgson, 2006). But when used as a concept, it represents sets of norms or rules. From this understanding, the concept of institution can readily be interchanged to represent the varying connotations or means of regulating human behaviour (North, 1990). With this study, when the term ’institution’ is used to represent an organised entity, it will be referred to as ‘an institutional structure’, whereas when used to describe a collection of ‘norms’ or ‘rules’ (system), it is referred to as a governance system.

Applying this insight, this study progress to explore the social-political history influence in restructuring pre-colonial institutions, norms, beliefs, and ideologies for the purpose of fashioning natural resource management institutions. For example, history demonstrates that ideas, ideologies, traditions, beliefs, norms, and values are important for foundational structures for social-economic progress, such that exploring these elements evolve in institution structuring can provide constructive insight into natural resource management, societal change and economic dynamics (North, 1994). However, to better understand how institutional structuring underpin governance system and capability design evolve into legal instruments for natural resource management within a defined social-political context, there is the need for an exploration of practical cases that reflect this interdependency and evolution. Thus, reviewing how peoples depending on precolonial thoughts, ideas, and rights for subsistence agriculture and livelihood were restructured by colonial legacies into commercial cultivation substantiate that claims that restructuring of institutions could influence natural resource management outcome (Collier, 1998). This insight illuminates what element underlie institution configuration either for natural resource management sustainability, social justice, social stability, collective wealth distribution prosperity or sustainable development.

2.3 Institutions and Economic Development

This study has explained the relationship between informal and formal institutions and how they interrelate for shaping social outcomes using rules for facilitating opportunities as incentives and sanctions for misbehaviour to establish social stability. Although, economic development studies can generate solutions by structuring policies and processes for economic outcomes based on specific disciplinary theories. However, economic outcomes that leverage the interdependency of unique institutions are not unidimensional. Rather such

outcome facilitated by the foundation institutional structures and system for developmental policy conception are more likely to reflect the overall interconnections underpinning the institutions (Mantzavinos, 2021). The economic outcome become a rationalisation for rules, values, and behaviours and explains the normative effect of social processes as a social scaffolding for constraining, unifying and shaping patterns of human behaviour towards social-economic progress (McGinnis, 2016). However, for rules or norms to transform into formal institutions, they have to be broadly distributed and accepted for mutual understanding and unconscious commitment to patterns within context (Searle, 2005). Nevertheless, such formal rules underpinning policy conception for regulating structural and systemic change may require mediation between the subscribing social entities for enforcement. Yet, formal rules underpinned by norms and values that evolve from the collective choices along historical, customary, and geographical ties may likely facilitate less complex institutions (see Stokke, 1970). This suggests that where constituents of informal norms and rules are excluded from designing formal rules, the enforcement of such rules can generate its own complexities that may constraints of voluntary compliance and conflictual situations (Carden and Coyne, 2013).

Additionally, synthesising informal institutions into formal institutions to regulate economic interaction in pluralistic contexts may experience its own enforcement subjectivities if not transparently structured and accountably defined. This suggests that as social scaffoldings, building non-participatory institutions and overlooks the accountability elements may to an extent regulate complex social interaction in the economic processes (McGinnis, 2016). But, transparently pursuing commonalities through collective action when structuring institutions can reduce unhealthy rivalries that sometimes make mediation and negotiation less complex, and contribute to enforcing accountability in the economic process

(Maman, 2022). For example, Carden and Coyne (2013) explain norms and rules evolve into institutions using an analogy of social relationships scenario where informal rules reinforce formal rules during the Memphis riot of 1866. From theoretical insights from cited studies, it is difficult not to assume that the enforcement costs of formal rules will be low when legislated prescriptions align with voluntarily subscribed norms, values, and beliefs. However, the relationships and processes that moderate societies through unwritten, but binding non-contractual mechanisms such as prescriptive norms, rules, and values may be determined by historical legacies, sensitivities, persistency of politics, or level of social tolerance (Glaeser et al., 2004). For example, Stokke, (1970) suggested that the rationale for integrating different institutions comprising of norms and values into a homogenous cultural, administrative, and judicial system in northern Nigeria was self-enforcing and validating deep and accepted historical and religious roots.

From the knowledge of the relationship between informal and formal rules, structuring institutions as social-economic scaffoldings for natural resource management without explicitly acknowledging pre-existing relationships and processes may likely hamper the effectiveness of institutional structures and system targeted at addressing social problems. For example, North (1994: 363) submitted that 'belief structures get transformed into societal and economic structures by institutions.' This fluidity of two-way interdependent feedback and trust building loop can structure positive social-economic interactions and reciprocities amongst human elements, but can equally catalyse conflictual situations within a context (Mantzavinos, 2021). Nevertheless, as informal rules are synthesised as social scaffolding through trust-building into formal institutions for moulding behaviours in social-economic interactions (Knack and Keefer, 1995), any misalignment may require collective action or institutional coercion to stabilise the unintended consequences (Carden and Coyne,

2013). However, the effectiveness level of institutions or its capability and manner of enforcement can be uncertain in a natural resource setting with multiple layers and scale of social interaction exploring sustenance and livelihood (Robeyns, 2017). This suggest that in contexts where the institution structures (entities) experience capability and enforcement challenges, discounting penalties for contravening institutions may only generate its own cost to the extent to which such entities are willing to hold them accountable for impeding household income and community social-economic outcome. This is one argument that this study will interrogate in the survey context to understand if the institutions for natural resource system are structured for effectiveness or social-political expediency.

2.4 Institution Restructuring: Exploring Pre-Colonial Institutions Relationship with Post-Independent Institutions

In pre-colonial Nigeria, historical accounts suggest that distinctive social groups encouraged broad-based consultation for informal institution constructs for their social-economic progress. However, as narrated by Riddick (1968) and Stokke (1970), ethnically and politically dichotomous social groups with distinctive values, beliefs, and ideologies with different scales of traditional economies along with these informal institutions were integrated without organically resolving the complex sociological differences in the 1914 amalgamation of northern and southern protectorates. But, Ake (1993) insist that Africa's communalism defines the social systems' perception of freedom and human aspiration as the appropriate mechanism to facilitate social progress. Also, Noronha, (1985) argued that pre-colonial ideologies organically shaped by proximate geography's biophysical characteristics contributed to human development of their social identities, rules and behaviours to forge institutions and economic outcome. However, the coercive administrative integration of divergent informal institutions comprising social-political, religious, ideological, cultural and

linguistic groups, predicated on strengthening important institutions structures and systems, without bargaining and facilitating voluntary arrangement into a unified social, ecological, and economic system has been suggested to be influenced by the colonialist's bias for access to natural resources (Stokke, 1970; Osaghae and Suberu, 2005). Yet, this incoherent multiple ethnic groups integration without deep and extensive social consultations, bargain and mediation may have contributed to the elongation of colonial institutions influenced the existing social contract underpinned by present-day governance system design (Suberu, 2019). Besides, this problematic unification of institutions suggests the interference of an organic evolution of pre-colonial social-cultural and geographically rooted institutions process. Meanwhile, Michalopoulos and Papaioannou (2013), based on the discovered empirical irregularities on ethnic-specific attributes and economic development, recommended a future study to clarify how local ethnicity-specific institutions shape economic performance. Thus, suggesting a social crack in the foundational institutional structuring of social contract may underlie the problematic roots of natural resource management institutions design, and its capability and enforcement outcome.

Firstly, hard-to-quantify evidence about social relationships and processes related to institution structuring based on its social-cultural, ideological and geographical underpinnings makes the reliance on the historical narration of institution evolution in Nigeria one-sided and implausible. Meanwhile, insights from literature review reported that most ethnic groups in the northern region belong to some extent to a hierarchical religious and political system whose judicial and administrative structure is still homogenous to date (Riddick, 1966) and the uneven with the social-economic development in the south-western and south-eastern regions (Stokke, 1970). Yet, these historians narrated that the northern traditional leadership, in consultation with the colonialists, preferred the preservation of their ethno-religious values

by restricting education to mostly Koranic education in the predominantly Muslim North. Likewise, other minority ethnic groups around the middle belt were mostly reported to have unified with the core north through religious and common language integrated into their cultural system administrative and judicial superstructure. While the northern emirs requested the colonialist to keep Christian missionaries out of the predominantly Muslim geography in the North to preserve their Islamic religion by excluding Christian missionaries (Stokke 1970), as social-culturally distinct south, with social polarisation between the west and east, introduced western education through missionary schools up to the end of the second world war when the state made a modest start in the field of education. Yet, education as one of the sustainable development goals has proven to be the most crucial factor for social-economic developments across different context (Brundtland et al, 1987).

Additionally, as described by Stokke (1970), the Yorubas, with their legend of a common origin, language and similar political and administrative traditions, was the main ethnic group, constituting two-thirds of the population in the south-western region. The major group of the south-eastern region was the Ibo that constituted approximately three-fifths of the total regional population. Nevertheless, the social relationship of any kind can be probabilistic, without concretising opportunities for social reengineering and economic progress. Although these ethnicities have had a long history of well-structured informal societies and cultures (Kalu, 1980). However external influence, historical accidents from interethnic relationship reconstruction can be consequential for social cohesion (Collier, 2010). No doubt the amalgamation of diverse cultural values, belief systems, traditional economies, ethnic colourations predate the advent of post-colonial plans and purposes for institution restructuring. It is for this reason that the study argues that any tendency to link institution to social-economic outcome solely on the basis of economic reasoning as

apparently oversimplified. For example, Posner (2004) submitted that the perception that Africa's economic woes are an outcome of pluralistic ethnicity is worth empirical examination. Likewise, Easterly (2001) argued that ethnic divergences have had tragic consequences in human history of producing a poor foundation from which a subset of institutions evolve. However, Huntington (1996) argued that societies should never be expected to pursue unified behaviours, especially where the fundamental source of conflict transcends ideological to cultural focus. Nevertheless, it is uncertain if the effects from the contrast in the evolution of institution structures in Nigeria based on divergent ideologies will be reflective in natural resource management outcome and the realities of social-ecological system stewardship.

The illustration of how divergent ideologies can underpin institution structuring for natural resource management with variability of outcome needs to be explored further. Besides, economic development is about managing and evolving relationships and finding a common ground for building growth-enhancing structures and systems (Alesina and Giuliano, 2014). Moreover, Agrawal (2003) argued that most natural resource system are managed by social groups divided along multiple features that includes ethnicity, gender, religion, wealth, and social class. Additionally, social behaviours and practices can also shape the relationship between the natural ecology and institutional evolvement (Laflamme 2010). In light of the social-ecological system perspective of the economic problem, whether institutional structures on governance system design, capability and enforcement influenced by colonial political and economic legacies are efficient for natural resource management and the social-economic outcome is worth studying further. While it is beyond the focus of this study to explore the divergency of social history and economic outcome, Miguel (2004) provide theoretical insights on how the integration of pluralistic ethnicities influences social-economic outcomes. Nevertheless, ignoring deep-rooted hereditary processes in exploring

institution effectiveness linkage to contextual social-economic complexities may mean circumventing the process of identifying the problematic roots.

Indeed, many studies point to the influence of social-political differences between the different regions in institution structure, yet not many of these studies explores the historical and social-cultural underpinning of foundation structures. Thus, beyond the existing arguments, the study examining the research problem in the Nigeria context relied on published literature that suggests pre-colonial social groups in present-day Nigeria have had a long history of influencing rule design and institution structuring based on distinctive beliefs, cultures, values, and ideologies (Stokke, 1970; Kalu, 2008). However, the social and institution restructuring of the social-cultural belief systems, local markets, and traditional economies that predate the colonialism, despite their institutional differences into a unified and common administrative institution structure without a reinforced social contract bargain is suggested to contribute to problematic social-political relationship in Nigeria (Osahgea and Suberu, 2005). But Glaeser et al. (2004) emphasised that colonialists primarily brought with them their human capital, rather than the importation of their institutions. No doubt, other countries that have experience similar colonial influence in institution structuring have been able to facilitate effective institutions for natural resource management and social-ecological system safeguard without a mutually reinforced social contract (Cloutier et al., 2021). Nevertheless, considering the approach to institutional restructuring, it is uncertain how the sparsely bargained integration influences the capability and effectiveness of these institutions emanating from colonial coercion for natural resource management and facilitating social-economic interaction. For example, Acemoglu et al (2002) explorations of social-political relationships in Botswana and White (2004) broad exploration of post-independence social relationships and processes between Malaysia and Singapore provide knowledge to support

these arguments of countries that have evolved their social-economic system beyond their colonial histories. Nevertheless, Collier's (2017) analysis of Miguel (2004) natural experiment using Kenya and Tanzania, and Hjort (2014) rigorous experiment; evidently demonstrates that tribal identity, defined by norms, values and narratives were deployed using tribal affiliations against the collective interest and development of the society. Therefore, a starting point to pursue institutions formation for economic development can be to diagnose social antipathy expressed in different degrees of polarity within contexts can influence the structuring of effectiveness institutions. To resolve this argument, the effectiveness level of the governance system emanating from Nigeria institutions based on its social-political legacies need to be evaluated empirically to confirm its influence on natural resource management, SES safeguards and the social-economic outcome in response to Objective 2.

2.5 Institutions Restructuring Social Contract Bargain and Effective Institutions Design

Linking colonialism with post-independence institutions is theoretically unravelling the shift, evolution of institutions and social-economic interactions. Besides, the history of absorbing colonial values, blended with social-cultural ideologies, norms and values may have imposed atypical rules that can dynamically alter the evolution of precolonial institutions, property rights and social-economic outcome. However, citing the Botswana case study, Acemoglu et al. (2002) reported that the influence of external values in colonised contexts was minimal. Moreover, the intermingling of individual and group values with inherited norms and social-cultural beliefs offers opportunities to internalise external knowledge to evolve more effective approach for natural resource management. But, social-political governance with foreign established administrative and legal mechanisms may have supported, to varying degrees, the introduction, domestication, and legitimisation of the English values, norms, and institutions into post-independence institutions and society

(Francis, 1984; Kohn and Reddy, 2017). For example, the Nigerian land use legislation that alienated the precolonial customary rights was crafted from the colonial land ownership rights for government administration laws of 1924 (World Bank 2016). Likewise, the colonial land ownership rights diffused into the Property Rights Act introduced in 1978 under military administration are still in force today. Besides, the introduction of civil service and the subsequent recruitment of local indigenes to serve in education, healthcare, law enforcement, and other institutions may have contributed to the philosophy of contemporary institutions. However, what is the social-economic focus of each ethnicity based on the divergent ideologies, and how does this intermingling of precolonial social-cultural ideologies and values with external norms values and norms correspond with the collective aspiration of the integrated institutions. Besides, where the normative expectations of collection aspiration deviated from each individual or social groups practical experience, what and how resilient is the mediation mechanism for social-economic remedy (see McGinnis, 2016). It is suggested that these pertinent considerations need clarification before linking effective institutions to social-economic outcome in a polycentric governance system

From the theoretical review, beyond the linking institutions to economic progress, the intrinsically complex structure within which these institutions' structures and systems evolve can also influence the effectiveness. For emphasis, the effectiveness of institutions in this study is perceptive of contextual stakeholders' bargain and social contract which may by underpinned, but not limited to the influence of social history, norms, values, ideologies (Searle 1995 and Ostrom, 2005). The stakeholders may comprise diverse informal norms, beliefs, and values, as well as diverse informal and formal community-based associations, government agencies, private corporations, professional groups, and other non-governmental organizations. Thus, the theorising effective institutions may more complex

that currently understood. This is just as the governing natural resources endowment with institutions underpinned by multilateral linkages may be complex and not necessarily efficient (Hodgson, 1998). Nevertheless, studies have stressed the importance of institutional structures and systems as scaffolding for coalescing social divergencies and accelerating economic development (La Porta et al., 1999; Collier, 2010). However, the objectivity and subjectivity of institutions in informal settings may not guarantee structuring of effective formal institutions because of trust building issues underpinning social relationships. But, in contexts where contextual norms and values conflict with formal rules, stakeholder's incompatibility problem that likely stimulate more complex consequences for social-ecological system interaction can be assessed if influence the effectiveness of natural resource management.

Based on the theoretical insights, this study argues that the normative expectation of the convergence of divergent of informal and formal commitments through shared understanding and collective bargaining to construct institutions, including laws, rules, norms, and values to guide social-ecological system interactions may not necessarily translated to effective institution for natural resource management. Besides, a participatory approach to institution structuring and governance system design may not guarantee the practical outcome of attaining the collective, individual, or group expectations that underpin effective institutions without accountability for each social actor's interactions in the social-ecological system. Although Ostrom's (2005) polycentric system approach provides comfort for the difference between normative expectation and practical realities of institution structuring to vulnerable social groups for more participatory governance system. Specifically, Searle's (1995) collection intentionality submits that social actors should commit to the acceptance of particular individuals or groups to act as monitors for social-ecological system

interaction to assess compliance as part of the constitutive rules. Thus, the convergence the normative expectation and practical reality in a polycentric governance system rests on the perception that any definitive social group experiencing common problem in the social-ecological system can access multiple means of resolving shared problems (McGinnis, 2016). Nevertheless, in contexts with different property rights consisting of overlapping institutional structures, but superintended by a centralised governance system, accountability may generate complexities. For example, in a context with varying power ratios in the face of social-ecological system breakdown, nominated monitors in a collective intentional or polycentricism may experience difficulties in ascertaining which regulatory agencies or social actors to hold accountable governance system capability and enforcement infractions. Thus, the need to examine the practicality normative institution structure expectations and the effectiveness level of a governance system capability and enforcement.

Within a common-pool natural resource system, people are incentivised and obligated to act with sensitivity to norms and values when interacting for social-economic relevance (Trebilock and Veel, 2014). This suggests that just as it is difficult to ascertain under what condition efficient institutions evolve. It also difficult to ascertain whether contextual social-political arrangements structured institutions for political expediency or economic efficiency in natural resource-dependent context. Nevertheless, social-economic outcome is not isolatable from contextual institutions objectives and capability, nor do institutions exist in a vacuum (Dasgupta and Maler, 1995). Thus, in examining natural resource management outcome myriads of questions are likely to erupt on the condition under social-political arrangement and institution structures evolve. However, exploring the deep-rooted natural resource management complications of Nigeria suggests that geographical delineation, precolonial social-cultural attachment to/and history of context, and external influences that

influence institutional structuring are important. Likewise, understanding how institutions historically burdened with a panoply of ideological, social-political, social contract complications, plays out in Nigeria's natural resource management emphasise why this study is important. Moreover, Martinez Allier's (2014) environmentalism study provides an overview to the conflictual consequences of extricating the developmental process from the dynamism of social norms, values, and ideologies and its consequences on social stability in Ogoniland natural resource management. Thus, this literature points to why examining the effectiveness of institutions regulating natural resource system and its social-economic outcome that may lie beyond existing studies positionality.

2.6 Chapter Summary

This study theoretically explores the institutional theory and the interdependency of informal and formal institutions in influencing natural resource management. After explaining how norms, ideologies, and beliefs interrelate to institutional structuring, the study advanced to institutional analysis by integrating ideas from previous studies to clarify the distinctiveness of formal and informal institutions, their interdependencies, and how they collectively influence the structuring of effectiveness institutions. Then the study briefly extracts historical case studies to explain precolonial social institutions and colonial legacies' influence social arrangement and institutional structuring for natural resource management. After acknowledging the contribution of historical specificity that influenced the restructuring of institutions for natural resource management beyond the persistency of its precolonial informal rights for modern-day governance system design. This study argues the normative expectation of the convergence of informal and formal institutions deviation from the social-ecological system realities with adverse social-economic effects can be an important indicator for accessing institution effectiveness. Now that the how, why, and what factors influence

effective institutions' structuring have been reviewed, this study proceeds to evaluate the effectiveness level of natural resource management based on the governance system capability and enforcement within social-ecological system around oilfields. The chapter contributes to knowledge of institution theory, specifically the evolution and structuring of effective institutions.

Chapter 3

Justifying the Theoretical Framework for Examining Natural Resource Management Interlinkages with Social-Economic Outcome in Social-Ecological System Around Oilfields.

This chapter theoretically explores the considerations for governance system design and regulatory enforcement in SES around oil mining fields in response to Objective 3, "to explore how the effectiveness of natural resource management institutions linkages to social-economic outcome can be evaluated from the perspective of the social-ecological systems around oilfields. Also, it explores the influence of institution structuring on governance system design, and the pattern of interactions for social-economic development. It then briefly reviews the relationship between institutions theory and social-ecological system theory through the Institution Analysis and Development (IAD) framework (Ostrom, 2007). Additionally, it provides the rationale for adopting the SES theory (McGinnis and Ostrom, 2014) to examine the multiple levels and scale of interaction in the natural resource system beyond economic reasoning alone.

3.1 Introduction

From the analysis of literature in the preceding chapter, natural resource management remains a cultural and social-politically sensitive and economically complex undertaking that interconnects multiple systems, institutions, and people from local mining contexts to other geographies through dynamic social-economic networks. If effectively managed, natural resources can become a sustained revenue source for social-economic development (Acemoglu and Robinson, 2006). But, when ineffectively managed, it could trigger different social-economic outcomes. Yet, overdependence on oil resource extraction has been argued to expose economies' social-economic complications that erode domestic competitiveness (Collier, 2010). However, not many expansive studies that explored natural

resource management challenges in natural resource-dependent contexts have keenly focused on understanding the depth of institutions interdependencies, the factors contributing to institutional foundation and the social-ecological system condition under which the county's social-economic outcome to determine if the natural resource management institutions are effective. And if they are not effective, what are the factors contribute to and the consequences of their ineffectiveness. Thus, the earlier chapter explored factors influencing institution structuring for natural resource management and the varying implications of pre-colonial norms, values and belief, ideologies underpinning social-cultural attachment to geography and customary rights and formal institutions strengthened by constitutional authority, on institutions effectiveness and social-economic outcomes.

This study suggests that one of the factors contributing to the challenges of natural resource-dependent economy may be the misalignment of institutions. But, it is unclear if the existing interpretations of the Nigeria social-economic phenomenon from the perspective of resource curse theory (Auty, 1993), Dutch Diseases or institutional weakness (Corden and Neary, 1982, Sala-i-Martin and Subramanian,2013.) or rent-seeking (Beblewei and Luciano, 1987), if at all plausible, could have arisen from the mismatch between institutional capability and enforcement effectiveness. Meanwhile, institutional capability is described as the ability to design and enforce a governance system for regulating natural resource extraction with appropriate sanctions that incentivise multidimensional social-economic development without overlooking the nearby social-ecological system safeguards (Robeyns, 2017). Consequently, institution effectiveness in this study refers to the capability of an institution to transparently and accountably enforce its operational rules to constrains rule breakers according to the prescribed penalties. But before delving deeper into Nigeria's economic problem, this study explores the relationship between institutional structuring, governance

system design and enforcement, and the social-ecological system outcome to determine if the natural resource management institutions are effective.

The previous chapter has explored and described institution theory, informal and formal institution configuration, and their interdependency. For example, empirical findings have suggested that the economic mismatch between natural resource endowment and wealth creation in Nigeria could have emanated from its institutional factors (Sala-i-Martin and Subramanian, 2013). Also, Stevens et al. (2015) added that any natural resource-endowed country with ineffective institutions is more likely to experience economic crises. Besides, other empirical conclusions have argued on the linkages of weak institutions, natural resource endowments, and economic crises (Ross 2013; Collier and Goderis, 2012). Yet, Kaufmann et al. (2005) and Allellaneda (2006) argued that limited knowledge of good governance is inadequate to back the negative effect of linkages between institutions and oil resources. Also, Torres et al. (2012) underscored that oil resource abundance is less significant in contexts where the concentration of oil resources benefits from fiscal responsibility and effective institutions. Nevertheless, natural resource system value loss in SES can outweigh accruable foreign exchange expectations from oil resource exports if the ecosystem services are appropriately valorised (Walker et al. 2010). This argument suggests that isolating the natural resource wealth contribution to social-economic outcome, without considering the SES interactions influenced institutional factors could overlook the social-ecological system linkage of effective institutions linkages to natural resource management. Moreover, the ongoing theoretical analysis have suggested the influence of colonial legacies on the structure and systems of the institution framework for natural resource management (Osaghae and Suberu, 2005). Therefore, institution theory may seem plausible for exploring the core ingredient in designing regulations for common-pool natural resource system in the SES

around oilfields (Ostrom, 1990). But, the effectiveness of institutions needs to be tested by its capability and enforcement outcome on the ever-changing intertwined biological, social, ecological and economic system with a combination of other sub-systems constituting the geographical space. Thus, this study is uncertain if coerced institutions and system of rules with divergent ideologies, historical legacies and attributable values to the natural resource system can influence the effectiveness of foundational institutional structures to transparently and accountably enforce operational rules for the SES safeguards.

The evolving insight suggesting that previous theories for interpreting economic problems of natural resource-dependent contexts may have insufficient knowledge factors underpinning institutions effectiveness for natural resource system management. Nevertheless, after exploring the historical legacies underpinning institutions evolution and other evidence linking the natural resource social-economic paradox to institutional problems (Stevens et al, 2015), this study suggests that the effective institution can be assessed through the design and enforcement capability of governance system within a social-ecological system context. Nevertheless, institutions that design incentives and constraints themselves are social derivatives of a web of complex social-political relationships and ideologies (Mantzavinos, 2021). Also, Porter and Watts (2017) underscored that natural resource-rich countries experiencing paradoxical performance and growth failures have strong relationships with contentious politics and ineffective fiscal federalism. Bebbington (2014) links the economic challenge in oil-dependent economies to political challenges. Likewise, Robeyns (2017) underscores the social-political values underpinning institution capability is pivotal to achieving human wellbeing, social justice and development. This suggests the dimension of social-political complications underlying social-contract bargain, institutional structuring and governance system capability and enforcement design for transforming

natural resource systems can be deterministic of its social-economic outcome (Agrawal, 2003).

Previous studies exploring natural resource-dependent economic problems have mostly focused on the triumphalism of effective institutions in natural resource management linkage to economic development without exploring the underlying factors influencing the effectiveness. However, the knot of substantially veiled, but complex institution underpinnings that influence natural resource management may be socially, politically, geographically, ecologically, and economically entangled in multiple contestations on what natural resource values are prioritised and how these values are explored. More so, interpreting effective institutions as deterministic for economic performance without considering proportionate enforcement of the property rights for equitable wealth distribution across social scale may be misleading. Besides, assessing the effectiveness of institutions from a top-down perspective without evaluating the consequences of their capability in natural resource management may also be one-sided. It is for this reason that this study delves deeper to apply the Nigeria's social-economic problem to examine the factors impacting institution structuring and the effectiveness of institutions from the perspective of natural resource management outcome.

3.2 Factors Influencing Institution Structuring and Governance System Design

The effectiveness of institutions can also be assessed from their capability to enforce crosscutting property rights for social-economic opportunities that safeguard the sustainability of natural resource values embedded in social-ecological system. This discourse is especially relevant to the natural resource-dependent context of Nigeria, which is perceived to have experienced underdevelopment from its natural resource management approach (Sala-i-Martin and Subramanian, 2013). Thus, if the condition for guaranteeing economic

opportunities from natural resource wealth transformation is absent, then it is important to trace if the institutions managing the resources are politically expedient or social-economically efficient. Besides, if development is interpreted as the freedom, equality, and justice associated with benefiting from natural resource systems sustainability (Brundtland, 1987), then natural resource management approach that effectively enforces property rights for accessing the exploration, and consumption of common-pool natural resource system can one of the means to sustainable development. Otherwise, developmental outcomes could raise the question of what ideological, social-cultural and political factors underlying institutions structuring and capability impact natural resource system sustainability.

Indeed, from the evolution of Nigeria's social-political arrangements and institution structuring, several key lessons can be drawn from the precolonial era to date. Although effective institutions have been suggested to accelerate social-economic progress (Stevens et al, 2015). However, economic progress can also emanate from an incremental flow of equitable natural resource value to the diversity of social constituents within an ecological system (Martinez-Allier, 2014). As a result, understanding economic development from the perspective of institutions implies considering what underlying factors influence governance system design, capability and enforcement. Consequently, exploring the process of structuring institutions, governance system design, and regulatory provision enforcement provided some clues as to why Nigeria's economic problems persist. Nevertheless, it remains examining how these archetypal institutions contribute to the flow of natural resource systems values to social-economic outcomes.

3.3 Institution Structuring and Contextual Political Arrangement

Indeed, findings from a wide range of studies have suggested that constructive and developmental economic outcomes can be catalysed by effective institutions. However, the

absence of ample empirical evidence of what constitutes an effective institution does not conclude on the type of social-political arrangement that can guarantee the structuring of such institutions (Adsera et al., 2003). Besides, effective institutions may be difficult to structure in contexts where political arrangements prioritise the material interests of natural resource transformation without considering the social reciprocity within the SES sources. Moreover, purposive people-centric political arrangements in heterogeneous ecosystems may support structuring effective institutions, social contract viability and governance system capability (Miguel, 2004). Yet, any attempt at hypothesising what type of political arrangement contributes to economic performance problems from an ahistorical, social, and political perspective might not fully understand the structural fluidities that underpin economic problems (Alesina and Ferrara, 2005). Meanwhile, it has been suggested that institutional ineffectiveness that burdens natural systems governance can equally emanate from social institutions mismatches (Hjort, 2005). Nonetheless, governance system design, especially when including divergent ideologies within informal institutions, is often an evolutionary process underpinned by layers of constituents' contribution to formal institutions legitimacy for public policies (Dressel, Ericsson, and Sandstrom 2018). Thus, it can be argued that institutions incompatibility can influence natural resource management outcome and SES stewardship with far-reaching impact on economic systems, especially when the pressures on natural resource endowment seem to overwhelm the capacities of institutions. Besides, acknowledging the diverse factors underlying institutions evolution and structuring, this study suggests that institutions influence on governance system capability design is an overlooked dimension of institution theory regulating the interactions within social-ecological systems. Therefore, a theoretical gap that this study is about to explore.

From identifying a theoretical gap on natural resource governance system, the study can progress to examine the social-economic outcome of this impact from the perspective of the dichotomy between commoditisation of oil mining and enforcing safeguard for other non-oil related natural resource system values that provides sustenance and livelihoods for multiple social actors outside the formal economic system capture. For example, Folke et al. (2016) emphasised that human development in all its dimensions is integral to the SES well-being, shaped and being shaped by people and societies in their ecological system. Strikingly, Bennet (2017), citing Locke, underscored that humans, irrespective of their social inclinations, are entitled to alienable natural rights of life, liberty, and property for individual self-preservation, which is ancient to humans and predates post-colonial Nigeria. Likewise, political dependence on the derivable fiscal value from natural resource extraction may overlook the broad attributable values to the natural resource system and sustainability of natural biodiversity and endangered species. This suggests that political arrangements that disproportionately overlooks the multiple natural resource system values and sustainability of natural biodiversity for oil mining proceeds may advertently expose its social-economic outcome to vulnerabilities. Therefore, by exploring the SES condition, this study explores other aspects of the often-unexplored sustenance and livelihood sources and the social-economic system outcome. Expectedly, insights from this exploration can provide survey evidence on the (1) effectiveness of institutions explored from governance system enforcement capability (2) the outcome of social-ecological system interaction in the context, (3) households income and communities economic development levels influence on national economy condition.

3.4 Examining the Research Argument from Human Perspective

The theoretical insights from exploring Nigeria's natural resource-dependent context suggests a complex blend of multiple interrelated sub-systems with different factors interacting at multiple levels of scale. Meanwhile, previous studies have concluded that institutional weakness contributes to economic performance (Hilson and Laing, 2017; Auty, 2017). However, mainstream economists also underscore the diversity of the economic value within the ecological systems based on the contributions of ecosystem functions and services to human sustenance, livelihoods, and communal economic outcomes (Freeman, 2003). Similarly, Bockstael et al. (2000) submitted that ecological benefits assessments in economics relate to its contribution to human well-being. But Folke et al. (1994) argued that only environmental systems that retain their replenishment cycle can sustain social well-being and economic development. This suggests that linking the social-economic problems to natural resource system management also needs to consider the effectiveness level of governance system enforcement capability in safeguarding the social-ecological system along with the natural resource values. Accordingly, this study focuses on the relationship between natural resource endowment, institutional structuring, governance system design and enforcement, SES condition and its social-economic outcome. Thus, the assumptions on the effectiveness level of governance system capability and enforcement can be evaluated from primary survey to reflect on the strength of the institutional structure, system and process they evolve from. However, generating knowledge on the research phenomenon will require examining the multiple level and scale of convergences underpinning natural resource system extraction in the SES.

3.5 The Evolution of Nigeria's Natural Resource Governance Institutions and The Institution Analysis and Development Theory Perspective

Different arguments holding explanatory influence over the Nigerian economic phenomenon (Auty, 1993; Sala-i-Martin and Subramanian2013) have be explored, but this study is proposing to evaluate the interrelationship between institution structuring, governance system design, capability and enforcement for natural resource management as key social-economic outcome determinant. However, beyond accepting its theoretical derivative, this study proposing the examining the research problem using primary evidence of the natural resource system value flow with social-ecological system condition will explore the sustenance and livelihood sources, aside from its oil mining values, to explain the problematic situation. Besides, institutional factors contribution to social-economic outcomes in the natural resource context, maybe the stifling of environmental resource flow for human wellbeing without negotiating a trade-off around its mining peripheral (Dietz and Neumayer, 2007). Nevertheless, in the Nigerian context with multiple ethnicities and multicultural institutions that are principally dependent on convergence of values, the social-economic outcome from natural resource management may experience nonlinear gatekeeping influenced by different layers of social-cultural, ideological and economic standpoints (Mantzavinos, 2021). Accordingly, Ostrom's (2007) Institutional Analysis and Development (IAD) framework, interconnecting the attributes of social, political, and ecological values underpinning the different levels of interactions during natural resource management institutions provides the empirical instrument to generate representative evidence institution effectiveness.

The multiple interactions between the social and political systems that are foundational to institutions structuring and governance systems design in Nigeria were

explored in Chapters 2. These interactions have been theoretically analysed from an institution theory comprising of different literatures (Ostrom, 1990, North, 1990 Hodgson, 1989 and Searle, 1995) and related to the IAD framework (Ostrom, 2007). However, this study argues that Nigeria's social-economic complication have not been given empirical attention from the social-ecological system perspective, particularly around Nigeria's oil mining context. Meanwhile, empirical evidence on governance system design has proven that natural resource transformations can unpredictably affect adjoining SESs (Torralba et al. 2018). Yet, aside from fact-finding studies on the social and ecological systems outcome of oil mining around the Niger Delta oil fields (UNDP, 2006, UNEP, 2011; Francis et al., 2011 and Sentamu et al, 2023), there are no known extensive and interdisciplinary studies at this scale, exploring the social, ecological and economic problems and its spill over to the national economic outcome from the SES perspective. Nevertheless, insights from foremost studies that have broadly catalogued the flow of ecosystem service provisions to social-economic outcomes will provide empirical guidance (Constanza, (2007; Barbiers, 2009; DeGroot et al., 2012; Dasgupta, 2022). Ecological system services, which is foundational to the social-ecological system (SES) theory, can be described as the outcome of revolving functionality and replenishable cycles of the natural biodiverse components that continually interrelate to deliver natural goods and services for human sustenance, livelihood and capability improvement (Ash et al., 2010).

The complexity of the Nigeria common-pool natural resource system with a dominant governance system, structural inequalities in social-ecological system stewardship and conflictual situations, may suggest another theoretical gap of previous studies attributing oil-mining dependent economy social-economic problem to institution problems (Ross 2013 and Morrison 2013). But these studies may have overlooked non-oil related natural resource

values in social-ecological system around oilfields impacts on sustenance and livelihood sources. This suggest the importance of exploring the multiplicity of factors and systems underpinning the relationship between SES interaction and social-economic outcome. Therefore, despite the IAD framework epistemological and ontological support for exploring common-pool natural resource problems, the complexity of Nigeria's ecological system around oilfields regulated by institutions with historical and social-political complications mostly midwifed by colonial legacies may be too complex for the IAD framework. Besides, the Nigerian context operates a centralised governance system in a polycentric system that subordinate other subnational laws and customary rights accruing to different social actors with multiple affiliations. This resource governance challenge despite the differing natural resource system values also generate its social-economic outcomes (Fagbohun, 2011).

Additionally, without cognising the arbitrariness of some social actors' empowered centralised governance system, in the context where natural resource system is explored and influenced by institutions bias from self-seeking political bureaucrats, the challenge of natural resource transformation may never be interrogated (Offiong, 1980). Yet, oil-endowed economies such as Saudi Arabia and Malaysia design organisations have successfully transformed their natural resource wealth to social-economic development without noticeable SES stewardship complications (Heller, 2018). But, Agrawal (2003) argued that institutional studies inattention external social, political features, physical environments features that influence institutions evolution make some studies vulnerable to criticisms. Nevertheless, evaluating social interactions in the SES theory applies the action situation concept derived from the IAD which includes the Interaction (I) and Outcomes (O) in the context where social actors interact to understand the interplay between the operational rules in place.

3.6 Transiting from Institution Analysis and Development Theory to the SES Theory for Exploring National Resource System Exploration Outcome.

Applying the Institutional Analysis and Development (IAD) framework that highlights the decision-making process within social, institutional, and ecological contexts for resolving social dilemmas of natural resource management is empirically useful for analysing problematic situations in common-pool resources (Ostrom 2011). This suggests that the evolution of institutions to governance system design and enforcement can be important to understand how the different attributable values to natural resource system are managed and transformed into multidimensional social-economic wealth. But, the IAD framework may too narrow for designing the theoretical framework because of the research problem broadness linking natural resource system values, social actors' interactions, uniqueness of the polycentric governance system and the ecological system disturbance (Epstein et al, 2013). However, the effectiveness level of the institution can be explored through governance system enforcement in the SES and its natural resource transformation and social-economic outcome. Likewise, McGinnis (2010) revised the SES theory to include additional classes of entities that are embedded in a social, economic and political setting in related ecological systems to combine the IAD and the SES frameworks with additional variables to track the impact of ecological system disturbances. Therefore, the need for a transition from the institution theory to the social-ecological system theory (SES) that captures multidimensional variables influencing outcome of the different level and scales of interaction (McGinnis and Ostrom, 2014).

The governance system designed and enforced to guide natural resource extraction, also shape how people interact within the SES and the social-economic outcome. Accordingly, the SES framework with more empirical scale and depth may prove more appropriate for

interrogating the complexities in the social-ecological system around the oilfields. The expansive social-ecological system framework (SESF) comprise first-tier variables starting from political settings (S) resource units (RU), resource system (RS), governance system (GS), social actors (SA) and interactions (I) illustrate the outcome (O), for examining common-pool resource problems with other subsidiary second and third tiers variables (McGinnis and Ostrom, 2014). Although, the research on SES propose to mobilise all important issues and concerns for exploring the outcome of the derivable value from the natural resource system. Despite the objective exploring the social-economic problem from the social-ecological system perspective in a natural resource-dependent context is fundamental, there may be no singular approach that universally suffices for resolving the complexities between institutions, SES, and economic systems. For example, IPBES (2019) identified over fifty assessment tools for analysing natural resource system values. Besides, Sewell (1992) underscored that institutions structures consist of many interrelated, interdependent elements, including alliances of different actors within the system. This suggests that ecological systems with diverse components and social actors may react differently to governance system enforcement in natural resource-dependent context. Thus, the one-sided perspective of the relationships between oil mining extraction and the SES condition with a variety of sustenance, livelihood sources, and values may generate different social-economic outcomes (Kumar, 2021). Unfortunately, measuring the natural resource wealth purely from oil industry wealth management perspective without capturing the variety of social-economic values may generate a one-sided perspective to problematising economic problem in natural resource dependent contexts. Yet, as currently suggested about the Nigerian context, the social-economic outcomes may be trapped by the social-ecological system condition. Thus, policy actors may only design solutions for navigating the social-economic crisis by understanding

the depth and broadness of natural resource system extraction influence on the hierarchy of the social-economic systems based on the social actors attributed values to the common-pool natural resource system. This suggests that as long as existing interpretations of the Nigeria phenomenon are not questioned from the new paradigmatic perspective, new knowledge about the social-economic complexities may never revealed.

In response to the suggested overlooked governance system capability and enforcement dimensions in institution linkage to economic outcome, there is challenge of the non-oil related natural resource values in social-ecological system impacts on sustenance and livelihood sources that can be applied for evaluating the effectiveness of institutions with respect to natural resource-dependent contexts. The insight from Chapter 2 is applied for building a theoretical structure will to explore how the effectiveness of natural resource management institutions linkages to social-economic outcome can be evaluated from the perspective of the social-ecological systems around oilfields (Objective 3). Specifically, this thesis seeks to evaluate the structure of natural resource system's contribution to social-economic outcome by examining the geographical setting, natural resource system configuration, productivity and replenishment cycle, social interactions and the sustainability of the resource system that support human sustenance and livelihood in the context. For clarity, sustenance refers to the means and ability to access basic human wellbeing needs such as food, shelter, and health. Although livelihood represents access to income sources for consumption or savings through means that are specific to available contextual economic opportunities. It is the consequences of the loss of this combination of sustenance and livelihood sources flow to households, communities' economic systems and the broader social-economic system that this research attempts to analyse. Therefore, from the SES perspective, the assumption of whether institutions emanating from Nigeria's social-political

arrangements are economically efficient, socially justifiable or politically expedient for natural resource management may be different from what governance systems are being designed and enforced to safeguard SES in the fringes of rural geographies.

This study may not fully capture the total biodiverse value of the natural resource systems even though the SES framework have been argued to be sufficient for exploring complex phenomena. However, the dimension of natural resource values linkages to the social-economic outcome will be dependent on the attributed value of the sample population perspective in the survey setting. Nevertheless, human practical experiences from their relationship with their natural environment is empirically valid for assessing social-economic outcomes (Ash et al., 2010). However, Dietz and Neumayer (2007) suggested that evaluating social-economic consequence of natural resource system extraction can apply a cost-based approach that captures the irredeemable, structural adjustment and restoration costs of ecological system degradation if externalities are internalised. This social-economic cost can then determine the impact of the ecological system degradation on social wellbeing by attributing values based on the individual or groups preference in specific natural resource system. Nonetheless, Barbiers (2009) underscored that ecological systems predominant with oil exploration can be valued from an economic perspective. Yet, to avoid relying too much of subjective social perception, Constanza (2017) stressed that sustainability-driven valuation requires designing an integrated model for ecological system services assessment based on quality, quantity, and timescale by evaluating the social-economic aspirations different social groups. Nevertheless, for a study proposing to explore a social-economic problem, these mainstream economist's perspectives may be too narrow measure the multidimensionality research problem with interdependent variables. For example, De Groot et al. (2012) underscored that any costs on the natural biodiversity that undermine ecosystem resilience

functioning, equally threatens the ecosystem services required for the organic plant and animal life interactions. This suggests that the ecological system benefits, such as regulating air quality, pollinating crops, enriching soil, and filtering pollutants, aside from sustaining the social-ecological systems safeguard can be assessed for its social-economic values and contributions. Thus, from a more reflective point, the SES framework (McGinnis and Ostrom, 2014), as an empirical extension of the IAD theory (Ostrom, 2007), possess more variables for exploring the blend of multiple interrelated sub-systems in the SES and the social-economic constituents.

3.7 Chapter Summary

This chapter explores the approaches for evaluating the effectiveness of institutions in natural resource-dependent contexts. It reinforces the study argument that as long as the social-economic problems in natural resource context are not questioned from the different paradigmatic perspective with theoretical thinking, understanding the research problem may keep recycling theories from previous studies. Thus, from exploring factors influencing institutions evolution and structuring, it proceeds to explore the social-economic outcome of natural resource-dependent context from the perspective of the social-ecological system condition where resource systems are extracted. It explores the appropriateness of the Institution, Agency and Development (IAD) theory and the improved social-ecological system theories for explore more complex problematic common-pool resource system. The social-ecological system is adopted for this study because its broadness and depth. Thus, the study proposes to design an extensive theoretical framework to examine the outcome of the interaction of oil and non-oil resource system extraction in the survey context and its flow of the non-oil related natural resource values to household income, micro-community economic outcome and its overflow on another social-economic system.

Chapter Four

Reviewing the Social-Ecological System Framework and Conceptualising A Context-Specific Theoretical Framework for Field Survey Exercise

4.1 Introduction.

From identifying the influence of social-political arrangements on institutional structuring, governance system design, capability and enforcement to understand the factors that influence the effectiveness of institutions from the perspective of natural resource system management outcome, this chapter explores the SES theory to guide the design of a diagnostic framework for examining the impact of natural resource management of social, ecological and economic system around oilfields. The chapter starts by describing the variables that make up the SES theory, map the variables into first, second and third tiers, before identify and selecting indicators based on the research aim to design a diagnostic framework to guide the field survey exercise, gathering and analysing of evidences. Then it proceeds further "to conceptualise and design a context-specific theoretical framework for investigating the sources of sustenance and livelihood in the social-ecological system around oilfields" (Objective 4).

4.2 The Description of Social-Ecological System Framework.

This study attempts to interlink the diverse components of the SES around the oil mining context to understand its social-economic outcome of natural resource management institutions. Thus, chapter maps the SES framework variables (setting (S), resource system (RS), resource unit (RU), governance system (GS), social actors (SA), interaction (I) and outcome (O) to link identified and selected indicators to explore household income and micro communities economic level overflow to the national social-economic systems (McGinnis and Ostrom, 2014). The usefulness of applying SESF in exploring the research phenomenon is

based on its extensity of examining the multiple attributable values to the natural resource system in the oil mining context. This implies that aside from understanding the contribution of SES services to the biological process, human sustenance, livelihoods, and social-economic outcome, it can also provide insight natural resource management safeguard of the natural biodiversity consisting of plant, animal species, genes and entire ecological communities to determine the effectiveness of institutions. For clarity, the SES is described by its geographical reflection, space and the interdependent interaction and feedback between social actors and natural resource system whose transformation and extraction are regulated through social-designed institutions.

4.3.1 The Rationale and Empirical Validity of the SES Framework

Empirically valid evidence requires selecting a suitable assessment scale to examine representative natural resource value flow to the different social actors across multiple dimensions. For example, Ostrom (2007) suggested SES theory as a diagnostic framework for conducting empirical research centred on exploring the patterns of interactions and outcomes from resource productivity or breakdown, social stability or collapse, and increasing returns or losses from natural resource transformation based on the influence of institutions. Also, by capturing the diversity of natural resource system value from ecological system services such as provisioning, regulating, supporting, and cultural identity to analyse the social-economic outcome, the usefulness and multidimensionality of SESF for determining effective institution can be validated. Yet Binder et al. (2013) submitted that no single approach can singlehandedly resolve problems resulting from the consequence of social-ecological system disturbance and natural resource system value losses. Moreover, Hinkel et al. (2014) underscored two major challenges for applying the SES framework to complex SES (1) the SES framework does not capture interdependencies in complex common-

pool resource system where multiple types of social actors conduct multiple activities that depend on and affect multiple RU and RS, and (2) the SES framework does not provide means to capture how multiple attributed natural resource values are connected, which however is exactly what generates the governance system challenges. Besides, Partelow (2018) identifies the problems of linking variables to context-specific indicators, which might impact the generalisability of findings. Nevertheless, Hinkel et al. (2014) underscored that SESF, as an empirically grounded tool is a useful starting point that provides a general language to define and analyse variables when examining the multiple level and scale of relationships, outcomes, and feedback on social, ecological, and economic systems. Although, the prospects of tracking natural resource values for all social actors from ecological system disturbance should not be expected to be straightforward. However, Leslie et al. (2015) submitted that the SES theory is theoretically grounded for integrating data and testing hypotheses about the dynamics, implications, and feedback interlinking human and natural systems. Besides, Partelow et al. (2018) argued that SESF supports methodological innovation by providing an overview of common methods to guide empirical analysis for transparency. Thus, exploring literatures SES on theories, can support the conceptualisation of an expansive diagnostic framework with well-defined strategy for field survey exercise, data analysis and to facilitate discussions on the applicability of research findings.

The primacy of applying the SES framework to explain Nigeria's economic complications is because of the versality of its variables that it is capable of exploring: a high degree of social heterogeneity, inequalities, power asymmetry among polycentric system interacting concurrently to extract different attributable values to the natural resource system all interacting at multiple levels and scales. As a dynamic system between social and ecological systems in an embeddedness, whose condition and outcome are influenced by

governance system and social-actor's interactions the context the survey evidence can also be applied in determining the factors that underpin the effectiveness of institutions based on the governance system capability and enforcement effectiveness (Bots et al., 2015). Thus, the basic idea of linking the interaction and feedback between socially structured institutions and the natural resource system is to reveal what patterns and processes influence ecological systems condition during/after natural resource transformation and the social-economic outcome (Agrawal, 2003; Ostrom, 2009). This suggest that natural resource extraction depending on the governance system capability and enforcement in place, can experience different consequences in form of externalities when private interests shift their cost to the general public. However, regulating the pattern and processes of social-ecological system interactions and the social-economic outcome linkage to the Nigeria's oil-dependent economic problem can suggestively determine the effectiveness of institutions. This aim focus on (1) exploring the natural resource system in the survey context and ecosystem functioning and replenishment cycle supporting it, (2) understanding the resource units' linkages to the diversity of attributed social-economic values by different social actors, and (3) identifying instances of SES unpredictability and factors contributing to it and its social, ecological and economic effects.

The SES around oilfields comprises several classes and layers of subsystems including oil and non-oil related natural resource system values interacting across multiple dimensions with other subsystems concurrently supporting ecosystem functioning and productivity. However, the outcome of multilayer social and ecological system interdependency with dynamic feedback around oilfields may react uniquely given different social actors (UNDP, 2006). Thus, for lack of a better definition, the term 'social-ecological system around oilfields' loosely describes a context comprising of social-ecological system in a complex interaction

with biodiverse species, oil mining activities and other social actors regulated by sets of governance system. For context, the purpose here is not to portray the SES around oilfields as definitive geography. Rather to contextualise the configuration of this geography setting designated as this study's survey context because of the industrial scale of oil mining with possible implications for social-ecological system stewardship and other social actors' sustenance and livelihood sources. Nevertheless, this SES around oilfields as a common-pool natural resource system provides both life-supportive natural biodiversity and non-renewable hydrocarbon resources depending of its social-actors identified natural resource system values (Francis et al, 2011). However, the functionality, productivity, and replenishment cycles of renewable natural resource systems around this SES may be vulnerable to the consequences of oil mining and governance system capability and enforcement with unpredictable outcomes (Sentamu et al, 2023).

A SES is described as robust if it prevents the collapse of ecological systems services and when its induced evolution does not disrupt its economic and non-economic potentials (Sandifer et al., 2021). However, the severity of natural resource value loss may likely differ on the system condition and social wellbeing, depending on its flexibility, frequency of the replenishable cycle disruption, and its component's resilience. From theoretical insight, this difficulty could arise from the dynamism and intertwined network of social actors embroiled in ideological, survival, and economic competition competing for resource system access and the accruable values from the natural resource system (Collier, 2010). Despite the difficulty of tracing social-ecological system condition linkages to social-economic outcome in oil mining context, this study propose the design of SES framework for guiding field surveys of human real-life experience based on their interaction with the SESs. Analysis of the survey evidences will expectedly generate results that will be interpreted to understand the

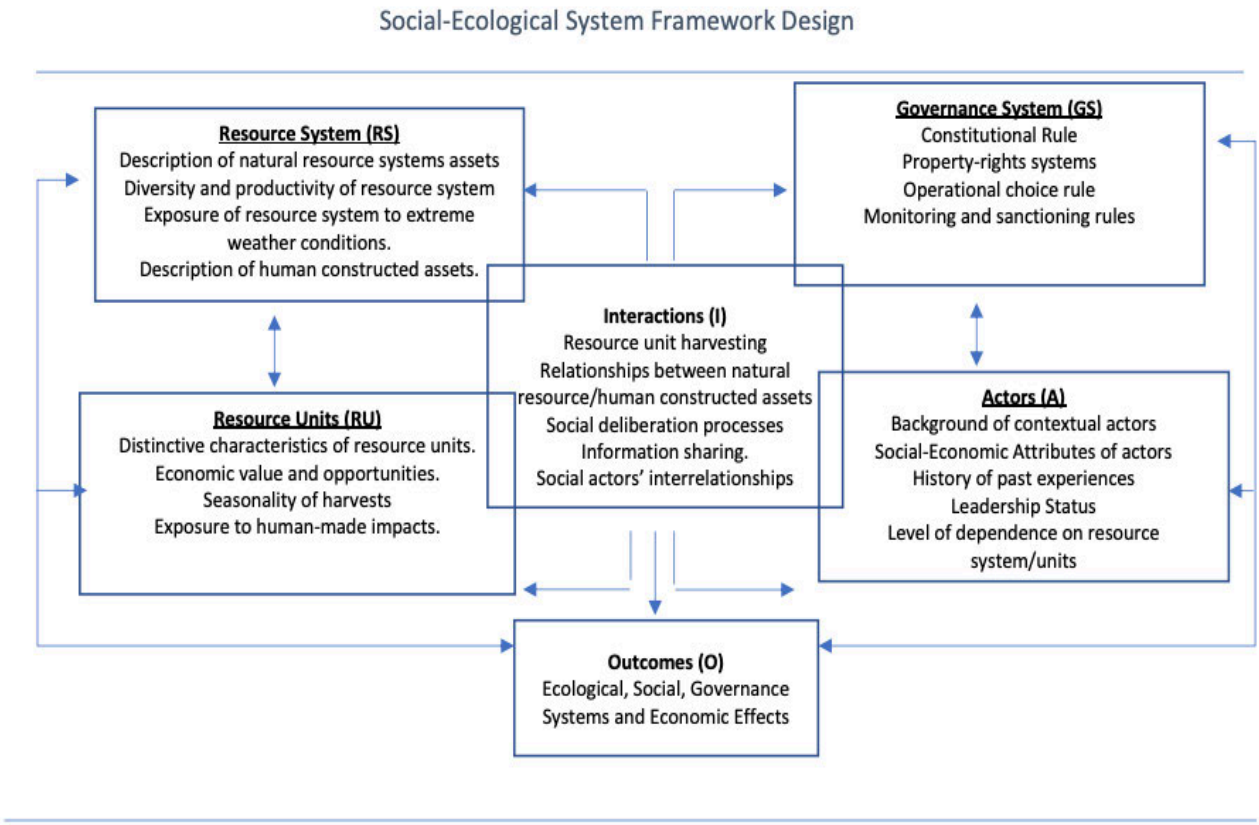
economic and non-outcomes contribute to the country's economic outcome. Economic opportunities represent the combinations of capturable or tradeable ecosystem services that contribute to natural resource values for human sustenance and livelihood (Kumar 2012). Non-economic opportunities represent the combination of non-tradeable natural resource values that support human sustenance and general well-being, but valuable to warrant social-cultural attachment to the social-ecological system (Ash et al., 2010). Therefore, considering the low knowledge of attributable value to natural resource systems around oilfields, this study further drills down to provide theoretical clarity underpinning the diagnostic framework design and application.

4.3.1 **Variables and Survey Indicators Identification for Social-Ecological System Framework (SESF) Operationalisation Plan.**

Considering the emphasis on appropriateness of the SES theory, applying its framework in this study is based on the mapped variable and selected indicators to explain the multiple dimensions and scales of convergences between resource systems (RS), resource units (RU), governance systems (GS), social actors (SA), interactions (I), and outcomes (O) in the SES around the oil mining context (see Figure 1) (McGinnis and Ostrom, 2014). Resource systems represent a designated geography encompassing a territory containing terrestrial, coastal, and marine resources where the combination of all the resource units is domiciled. Likewise, resource units are the components in the biodiverse resources that make up the resource system (e.g., trees, wild fruits, plants, fish, seafoods contained in the geography, diversity of wildlife and water system). Also, the social actors are individuals or group of people within and outside an ecological system exploring and transforming the economic and non-economic values in the natural resource system. Additionally, the governance system loosely described the specific body of social prescriptions, guidelines, rules and laws from the informal and formal institutions

regulations for human interaction with the natural resource system for social-economic outcome or social-ecological system stewardship. Furthermore, interactions influenced by the governance system are the reflected human behaviour and relationships with/among social actors for natural resource system extraction or social-ecological system stewardship (Ostrom,1990). The influence of this combination of the mapped variables interacting directly or indirectly at multiple levels and scales generate the effects, consequence or impactions that is referred to as outcomes (O).

Figure 1: Social-Ecological System Framework Design



- Social-ecological framework adopted from McGinnis and Ostrom (2014) and Ostrom (2009), but customised to study the research application by purposively-selected four second-level variables in addition to the first level variables to guide data collection and analysis in line with research aim and objectives.

Now that the SES and the variety of sub-systems in frameworks have been described to support natural resource systems analysis, it is important to categorise the survey setting based

on the SESF to empirically reflect how these variables will be mapped to support methodological rigour during its operationalisation of the survey instrument (see Figure 2). Then, the research study can generate sufficient evidence from field survey to the types of interactions, governance system effect and outcomes related to a particular natural resource system where oil mining is conducted, the related resource units, the different types of social actors exploring the variety of resource units, and the influence of the governance systems on each social actor's access and transformation (Bots et al, 2015 and Partelow, 2019). One of the contributions of this literature to theory is the ability to innovate a theoretical framework has never been mapped at this scale and depth for field survey exercise, data analysis and generating results and research findings to explain the outcome about research problem. Therefore, this theoretical synthesis provides the foundational knowledge for operationalising the SESF in a complex oil mining context to ease the examination of unexplored human experience evidence during field surveys.

The SESF is positioned as a tool to guide diagnostic SES inquiry, but its application varies substantially. Although recent pieces of literature pushing for SES research seek to build knowledge mostly through deductive methods associated with rule-based reasoning for socially perspective study (Cox, 2011), this study design a SES diagnostic approach that characterise a mixed epistemology by leveraging a case-based reasoning associated with inductive method, to strength the knowledge of ecosystem services contribution social wellbeing (Epstein et al, 2013). Yet, designing a diagnostic framework for complex SESs where multiple variables and their interactions jointly influence SES outcomes may grapple with the problem of selecting variables (Agrawal, 2003). Nevertheless, Nagel and Partelow (2022) proposed the need for more diverse and empirical SESF variables to identify crosscutting patterns interactions across of SESs. Thus, the motivation behind the diagnostic thinking is to rise beyond simplistic explanations for the overtly complex research problem by applying social-oriented knowledge explore the ecological

system characteristics, condition outcome without focusing the causality of its biophysical processes. Although, the SESF may provide a systematic means of linking perceptions and knowledge based on the experiences of human interaction in the ecosystem, without specifying variables contextual to study context, developing models and diagnosing the outcome might experience its own study bias (Partelow, 2018).

The social-ecological systems framework draws heavily from conceptualising SESs with a high degree of interaction, often with dynamic and emergent properties. But, the focus on foundational SESF variables interactions can obscure the nonlinear interactions within specific contexts (Bots et al. 2015). Thus, the SES theoretical framework as originally conceptualized for this research problem seem limited in its ability to understand this specific social-ecological system problems because it excludes certain variables for interrogating cases contextual to the survey setting. For a better explanation, new relevant ecological attributes that may influenced social-ecological system interaction and outcome has been identified (Schluter et al., 2022). Thus, exploring series of literature of the development on the SES framework, the study suggests its versality for exploring the research problem. However, proposing how social-ecological system study can be operationalised to explore social-economic problem suggest that the SES framework has to be amenable for economic analysis. The implication structural synthesis of concepts is identifying and considering new variables to supplement the foundational SESF variables with economic variables that can be empirically linked (Reyers et al, 2017). However, this approach might suggest increasing an already-complex framework. Nevertheless, the intent is both to derive an exhaustive list of potentially relevant variables and identify variables that most describe and represent the specificity of the social interactions (Bots et al, 2015). For this purpose, a modified SES framework served as a building blocks for developing, testing, and refining knowledge to meaningfully discuss the linkages social norms and property rights to

effective institution structuring for regulating ecological system disturbances and the social-economic impact.

As a new path is being explored for SES research theory development to examine a broader context-specific challenges, this study proposes a modification of the SES framework by including new second tier variables for contextual applicability rather than depending on wholly on the canonical SES theory. Nevertheless, this addition of new variables may suggest (Partelow 2018). However, another challenge can be a trade-off between comparability of study results and findings with diverse range of SES contexts to case-specificity problems that are highly relevant to specific contexts. While the former may necessitate measuring a more general list of broadly relevant variables at the risk of overgeneralisation or missing key variables (Gurney et al. 2019), the later generate practical contextual solution for policy actors. Nevertheless, considering that Binder et al. (2013) argues that there is no specific right or wrong approach to applying the SESF variables, Nagel and Partelow (2022) suggest that a modification of SESF variables can introduce inconsistency, transparency issues, and the inability to compare and contrast research findings from context-specific studies with others. Besides, according to Ostrom (2009:421) “If the initial set of rules established by the users, or by a government, are not congruent with local conditions, long-term sustainability may not be achieved. This study systematically follows a standardised procedure for developing a context-specific SESF for this study. Yet, such modified theoretical framework requires an in-depth knowledge of the SES theory and an elaborate theoretical review, synthesis and analysis for integrated versions of concepts, systems and epistemologies that may come at the cost of complexity in data analysis.

4.3.2 Contextualising the SES Framework for Exploring the Research Problem

4.3.2.1 Setting

The total land mass of Nigeria is 923,768 square kilometres; the Niger Delta geography occupies 84,616 square kilometres (NBS, 2013), endowed with natural biodiversity, minerals, and hydrocarbon deposits, and is located in the core southern region of Nigeria. This geography lies in the coastal and marine ecosystems between the borders of Cameroun and Nigeria's south-western states bordering the Republic of Benin, all overlooking the Bight of Benin. Spreading from the rainforest forest in the middle belt of country, mostly characterised by tall trees with and large trunk), to the freshwater coastal system (such as rivers, creeks, lakes, swamps, and mangroves), the geography traverses these wetlands before flowing into the Delta that empties via the Bight of Benin into the Atlantic Ocean. Nevertheless, this geography surrounded by the tropical rainforest is susceptible to occasional flooding events that often submerge communities along the lower Niger river during the rainy season. Human settlements in this geography consist of urban and rural areas, including many small island communities mostly interconnected by water bodies and occasionally paved roads (IUCN, 2018).

The south-south region of the Niger Delta comprises 6 subnational states that provide habitat to an estimated heterogeneous population of about 28.8 million people from over 40 ethnic groups, all distinguished by about 120 languages and dialects (NBS, 2024). The people are predominantly small-scale and subsistent farmers, fishers, traders and artisans, while several of them are engaged in public civil service employment, oil companies, or other private organisations. The region is famous for its large deposits of hydrocarbon reservoirs of about 37 billion barrels of crude oil and 183 trillion cubic feet of natural gas, from which over 95 per cent of Nigeria's total export annual earnings and about 65 per cent of government revenues are derived; out of which, the estimated volume of 34.9 billion barrels has been pumped out of the

numerous oil wells in different communities (UNDP, 2006). An estimated 817 million standard cubic feet (mmscf) of gas was flared between 2018 and 2020 (NEITI, 2021). The National Oil Spill Detection and Response Agency's (NOSDRA) monitoring online platform estimated 13,091 spill events totalling about 692,761 barrels between 2006 and March 2020.

4.3.2.2 Resource System

The Niger Delta environment includes four ecological zones: the coastal islands, the mangrove swamp forests, the freshwater swamps, and the rainforests. The swamp forest comprises of the flood forest and central swamp area with waterlogged soils covered by peat all crisscrossed by creeks. This suggest that the terrain interfacing the uploads and the Bight of Benin within the Gulf of Guinea is susceptible to flooding from persistent rainfalls, sea encroachment and ocean surges. The rainforests with isolated oil palm, rubber, cocoa plantations, are commonly dominated by different tree species that can sometimes reach a height of about 20 metres. This geography is also habitats to a wide variety of terrestrial and aquatic species, the swamp forests and adjoining freshwater system support approximately 60 to 80 per cent of natural biodiverse plant and animal species in the country, especially many endangered species (UNDP, 2006). Consulted studies reported that important wild lives around the ecological system (IUCN, 2018; USAID, 2020; Ogbeibu and Oribhabor, 2023). The different categories of crops cultivated within the study area are edible cultivated and wild crops, fruits, seeds, and stems. This rich biological diversity supports diverse species of terrestrial and aquatic life.

4.3.2.3 Resource Units

Agricultural production is the main livelihood source for most households in this geography. The different categories of crops cultivated within the study area encompass, but are not limited to, palm oil fruits, rubber, raffia palm, cassava, yam, plantains, banana, cocoyam, tomato, pepper, coconut, several fruit trees, mango and avocado, and a variety of other wild medicinal

plants. Consulted studies reported that important wild life around the ecological system includes beetles, butterflies, mosquitoes, ants, termites, Nile monitor lizards, parrots, antelopes, monkeys, bush pigs, buffalos, chimpanzees, African elephants, crocodiles, manatee hippopotamus, diving pelicans, bivalves, crabs, mussels, periwinkles, hermit crabs, deep-swimming shags, and a variety of freshwater and saltwater fish species (IUCN, 2018; USAID, 2020; Ogbeibu and Oribhabor, 2023). This suggest that the configuration of the ecological system to a large extent influences the people's sustenance and livelihood sources, occupation and vocation. For example, about 48 per cent of households engage in farming, artisanal fishing, and the gathering of seafood and wild plants for sustenance and livelihoods (NBS, 2013). Although, the region is famous for its large deposits of hydrocarbon reserves comprising crude oil, natural gas, and other minerals. More than 80 per cent of oil wells and a diversity of oil and gas installations and operational logistics, complete with multinational oil workers are co-located around different communities in this region (UNDP, 2006). However, available datasets reveal that natural resource systems contend with pressures from agricultural intensification, population upsurge, increasing natural resource consumption (FAO, 2016), and other unsustainable farming systems such as slash-and-burn practices for hunting and poaching.

4.3.2.4 Social Actors

The Niger Delta region provides shelter to a heterogeneous population of about 28.8 million, comprising over 40 ethnic groups all distinguished by about 120 languages and dialects (NBS, 2024). However, more than 44 per cent of the rural people in the region engage in farming, artisanal fishing, and the gathering of other agricultural products and aquatic foods. Another 18 per cent of the population are traders, 10 per cent in services and other artisan work, and the other 11 per cent in miscellaneous (NBS, 2013). A small population of migrant fishers from other parts of the country and nearby countries such as Cameroun, Togo, Benin Republic, and Ghana.

Besides, the region experiences an influx of traders patronising s fresh and processed farm crops and products, and fish and seafood harvests from local markets. Likewise, a large population of skilled and unskilled Indigenous and local workers, supplemented by expatriate workers comprising of different nationalities employed by the oil mining companies and their vendors migrate to communities near the oilfields. The presence of government regulatory agencies and their personnel, as well as different arms of the military and paramilitary forces, are noticeable in the security architecture across the region.

4.3.2.5 Governance System

The governance system represents the operational rule for moderating social and economic interactions by defining the why, what, and how the natural resource system is regulated and managed. These institutions that evolve and are developed enforce regulations and accountability for regulating the natural resource system for SES safeguard. Although there are myriad rules governing oil exploration in Nigeria, despite the recurring cases of unpredictability in the SES. For example, there is the customary rights that bestow property right to different social groups from the precolonial era (Osaghea and Suberu, 2005). The Land Use Act, 1978) that regulations property rights on all urban lands, but sometimes encroaches into rural lands to pave the way for urbanisation. Then, the post-colonial Petroleum Act (1969) that later metamorphosed to Petroleum Industry Act (2021) bequeaths the sovereignty and stewardship over natural resource rights to the federal government with extensive powers over customary rights and Land Use Act. This presence of intersecting rules and laws describes a polycentric system of governance (Ostrom, 2005). Yet, a greater portion of ecological system where oil is discovered and explored falls within the jurisdiction of customary rights with supervisory linkages to the Land Use Acts. Accordingly, once hydrocarbon is discovered in ecological system where customary right applies, the property rights based on the constitutional law is transferred

to the federal government. This implies that the Petroleum Industry Act of 2021 underpinned by the country's constitution from which other laws subsist, supersedes the 1978 Land Use Act and the customary rights. Meanwhile, in urban properties occupied by private individuals, the Land Use Act (1978) obligates the State Governors as the custodians of urban lands to revoke rights of occupancy if the land within their jurisdiction is required for petroleum operations by the Federal Government. This revocation is without recourse to the complex set of property rights that pre-existed oil discovery in Nigeria. Thus, many swaths of land, forest formations, and water bodies designated as cultural sites under families' and communities' holdings regulated by the customary laws are vulnerable to oil mining activities.

The overlapping governance system suggest the unpredictability of the normative expectations from the practical effects social interactions in social-ecological system in terms of oil mining access to non-oil related sustenance and livelihood source in communities near oilfields. For example, ecological system stewardship and safeguard is a residual matter domiciled within the state and local governments' jurisdiction to enact legislation for preservation, social order, and good governance (Fagbohun (2012). This oil mining governance system, as designed by federal laws, suggests a dichotomous relationship with the state, local government, and traditional institutions. Nevertheless, the broadness of the Petroleum Industry Act (2021) is presumed to cover all aspects of oil mining, without cognising the regulatory and enforcement gaps that may influence the social-ecological system outcome around many oil mining installations. But, citing the United States Congress Budget office (1997) under the economic theory of environmental federalism, Fagbohun (2012) submitted that the extensity of federal powers on ecological resource preservation can be curbed by allowing states to set localised regulatory standards. Yet the same USA Congress office (1997) argued that governance may likely achieve optimal efficiency when resource governance is structured to generate the

most potential for the entire country. But, Foster (2013) argued that a centralised natural resource governance mechanism is more likely to curb the excesses of free-market limitations. Likewise, Young (2002) underscored that a centralised governance system can facilitate the commodification and unsustainable consumption of the natural resources system. Therefore, the question of what natural resource system value is considered most important to the different actors in SES is a critical decision consigned to centralised institutions that are often far removed from oil installations, as well as may be bias toward the federal government fiscal priorities. Yet, even when the governance system is designed with participatory and accountability mechanism, there is other challenges of capability and enforcement to safeguard the social-ecological system condition in the oilfields. Therefore, exploring the effectiveness level of institutions in a centralised governance system with dominance over other property rights and its unpredictability in determining natural resource value flow is a key aspect of this study.

To reinforce the governance system, other subsidiary laws and industry standard prescriptions complement the governance system design. For example, the Federal Ministry of Environment, through the Nigerian Environmental Standards and Regulation Enforcement Agency (NESREA) and the National Oil Spill Disaster Response Agency (NOSDRA), regulates ecological system safeguards in the oil mining context in partnership with the Nigerian Upstream Petroleum Regulatory Commission (NUPRC) under the Federal Ministry of Petroleum Resources, overseeing oil mining regulation. Other layers of rules include the National Policy on Environment 1989 (NPE) and Agenda 21, which integrate the environmental standards for biological diversity and sustainability. The Environmental Impact Assessment Act (EIA 2004) assesses the environmental impact before project implementation to prevent negative SES impact. The Oil in Navigable Act (2004) prevents oil pollution of the sea by making regulatory provisions for the navigable waters of Nigeria. Environmental Guidelines and Standards for the

Petroleum Industry in Nigeria (EGASPIN 2002) provide environmental standards for oil and gas industry pollution control. Pollution in this study is loosely described as the biophysical materials in the natural resource system that generate negative effects on SES productivity. Furthermore, the recently enacted Petroleum Industry Act (PIA, 2021) provides an improved regulatoyr oversight for oil exploration both on waters and the continental shelf. It is the combination of well-defined sets of laws, rules, and regulations that describe the polycentricism of the governance system (McGinnis, 2016). However, it is moderating the intersection between the PIA (2021), the Land Use Act of 1978, and Customary Rights that bequeath different property rights to different state actors, especially in social-ecological system around oilfields test the capability and enforcement strength of institution structure and system. This exploration justifies the case-based and rule-based reasoning explore both the social-ecological system condition and institutions aspect of the research problem.

4.3.2.6 Interaction

Interactions are the effect of the other variables connecting at multiple levels and scales with the social-ecological system. Moderated by the governance system, each social actor's extraction decisions may be explored in the ecological system separately and collectively, in isolation or concurrently to determine the outcome situation. Interaction generates outcomes, which can either be tangible or intangible in the form of, for example, oil mining revenues or sustenance and livelihoods are outcome derived from natural resource units. However, interactions can be affected by and affect a resource system, resource units, governance system, and social actors who affect and are affected by social, ecological and economic factors in a defined context system (Ostrom 2007, 2009). Nonetheless, when describing the interactions happening at multiple levels, studies may need to break down the complexity for nuanced analysis (Ostrom, 2010; Herzog et al., 2022). This explicit mapping of variables at different tiers

and identifying indicators for operationalising (see Figure 2 and Table 1) may constrain the interrogation of social-economic phenomena without understanding the deeper influence of the effects and outcomes.

4.3.2.7 Outcome

The outcome is somewhat the different scale of consequences emanating from the social-actors interaction within the SES. However, in the case of oil mining, outcomes of one SES context may overflow to influence rules, structures, systems or interaction in other dependent contexts. Against this background, outcome represents social-ecological system condition influence by different governance system for social actors depending on different factors (Ostrom, 2005). For this study, outcome situation will be examined from real-life human experiences in the survey setting. Focussing on survey evidence will enable the data analysis results capture of the key identified dimensions of the SESF interactions to determine how their interaction generates or impact country's social-economic outcome. Evaluations of survey evidences are considered through sustainability lenses using ecological, social, economic safeguards, or any other indicator identified and linked with the mapped SESF variables.

4.4 Operationalising Social-Ecological System Framework: Mapping Variables and Identifying Indicators

4.4.1 Approach to Operationalising Social-Ecological System Framework

To further advance the operationalisation of the diagnostic framework, the study deductively explained demonstrated consideration of a philosophical standpoint, the methodological approach and the data analysis technique for examining subsystems facilitating human interactions, governance system design and enforcement to generate outcomes. The pragmatist's philosophical standpoint argues that social problems are best defined by the individuals experiencing them, leading to the examination of actionable situation. However,

while humans with lived experience in SES around oilfields are central survey instruments to this research study, their level of experience may depend on the differentiation between habits and intelligent habits. For example, Dewey differentiated between habit and intelligent habits to categorise the type of lived experience with the natural ecology that is suitable for empirical interrogation to achieve 'warranted assertability' (Boyles, 2006). However, the real-life experiences can generate their own subjectivities that may influence the data analysis result. Nevertheless, Plato (1989) submitted that the difference between theoretical and practiced-based knowledge is generated through experiences. Moreover, Johnson & Onwuegbuzie (2004 p. 17–18) described pragmatism "as the philosophic partner of mixed methods research" and offered a practical "middle ground" orientation between post-positivist and interpretivist in exploring complex research problems. Yet, the SES theory adopted for this study is replete with debates on ontological validity (Stone-Jovicich, 2015). However, Rigler and Peters, (1995) citing Kuhn submitted that some problems that old paradigms addressed may be dropped on the basis that new paradigms are better than the old ones. Besides, pragmatism provides a starting point of scientific inquiry between ontology and methodology, translating to an empirical epistemology (Bryman, 1984). This aligns with Kuhn's (1963) submission that pragmatism belongs to the extraordinary inquiry that creates scientific revolutions beyond the limits of traditional science. Thus, this study suggests the logicality of examining human repetitive real-life experiences to generate evidence for resolving the research problem associated with social-ecological system problem. Herein lies the connection between pragmatism and SESF, the value placed on practical human experience from the social-ecological system interaction can generate empirical valid evidence for systematic evaluation.

Considering pragmatism and SES both strive for social change that is meaningful to human population in a resource-endowed context, the SES study will view the nature of reality from an

integrated network of human practical and intelligent experience based on the perception of their survey setting. This implies that this SES theoretical (Ostrom and McGinnis, 2014) by exploring the human relationship with their environment aligns with Dewey's (1938) Pragmatist's instrumentalism. However, processing and justifying knowledge through the exploration of multiple human perspectives does not imply that the nature of processing knowledge is straightforward when settling for an epistemological stance (Frega, 2011). Yet, Creswell (2014) emphasised that pragmatism is the philosophy that permits mixing different paradigms, assumptions, approaches, and methods of data collection and analysis. Likewise, Tashakkori and Teddlie (1998) espoused pragmatism as the conciliation in the longstanding paradigmatic debate in historical context for mixed methods research. This lends to the appropriateness of mixed methods research, where quantitative data is collected and analysed to complement qualitative data and integrated during data analysis within this study (De Vos et al., 2019). Nonetheless, by outlining this paradigm and organising the field survey exercise, which applies multiple methods to collect data despite the reported risk concerns in the survey setting, this SESF diagnostic framework provides the strategy to navigate the expected challenges.

What makes up this study's reality, from research paradigm to field survey exercise, data analysis and interpretation, is systematically examining the research problem using an interdisciplinary mixed methodology that blends qualitative and quantitative data. Thus, a qualitative mixed-method approach that combines qualitative and quantitative survey techniques will sequentially capture diverse contextual human perspectives in the SES around oilfields, analyse and interpret field survey evidence (Creswell et al., 2017). Two semi-structured interviews are proposed, and a survey questionnaire will be administered during the survey exercise, complemented with evidence from secondary sources (Saunders et al., 2011). Finally,

contextual social and economic indicators collected from secondary sources are applied to control possible primary data source subjectivity for complementarity (De Voc et al., 2019). All field survey evidence is analysed sequentially using inferential statistical analysis in the quantitative segment to complement and corroborate thematic analysis results in the qualitative segment. The interview segments will be recorded, transcribed, coded, sorted, and interpreted to guide the data collection from the quantitative segment (Braun and Clarke, 2006). A code dictionary is designed, guided by theoretically driven SESF variables (McGinnis and Ostrom, 2014), using indicators based on the social, economic, and environmental system problematic situations from the research phenomenon and the guidelines provided by analysis by Tribaldos et al. (2020) and Herzog et al. (2022). Then, the results are integrated to generate findings for understanding the interactions within the SES with respect to the social-economic outcome at the household, community economic system, and national economic system levels. As proposed, this will provide a rich description of the field survey evidence, research findings, and knowledge. Expectedly, applying this SES study to innovate this diagnostic framework will generate credible, transferable, dependable and confirmable data analysis results and research findings (Lincoln and Guba, 1985). Besides, this study, based on a social-ecological system focus, selects a subset of necessary variables and introduces new second and third tiers variables based on the specificity of the survey setting and research problem under study for diagnosing the phenomenon (Hinkel et al., 2014). Therefore, this SES theory as an innovative multidimensional framework explores, interrogates, documents, analyses, and explains based on field evidence, result and outcome of the multiple layers of interactions characterised by different forms of randomness between individual, social groups, plants and animal species, and other contextual non-living things. The strength of evaluating social perspective based on the relationship with their natural environment is empirically valid for scientific analysis (Ash et al. 2010). Besides, by

capturing the diversity of natural resource benefits from ecological system services such as provisioning, regulating, supporting and cultural identity to assess social-economic outcome, the approach can support the versatility of the social-ecological system framework (Berkes et al, 2014). Nevertheless, without complementing field survey evidence from social perspectives with other datasets to reinforce the range, magnitudes, and consequences of the natural resource value flow/loss, data analysis result analysis may generate its own subjectivity. Yet, the relationship between natural resource system value and social-economic outcome cannot be entirely consigned to the subjectivity of individual experience, otherwise a one-sided evaluation may generate empirical bias. However, at the barest minimum, human practical experience assessment may underestimate the natural resource wealth below the real economic value (Blaikie and Jeanrenaud, 1996). Besides, aside from illustrating the insight underlying each variable, the diagnostic framework mapping applicable variables and identifying the indicators support its ability to generate credible evidence (see Figure 2, Table 1) (Nagel and Partelow, 2022). Thus, field survey evidence from survey setting provides the analytical data for generate study outcomes, rather than depending solely on secondary dataset.

Aside from justifying social perspective evaluation study, an epistemological valid approach will be to gather evidence from multiple sources to complement and corroborate the different perspectives of the interaction and the outcome. Thus, an SES perspective adoption of a mixed-methods diagnostic framework (see Figures 2 and Tables 2, 3 and 5) pushes empirical analysis from the theoretical phase to an operationalisation phase that generates holistic knowledge about the research problem beyond the scepticism of Epstein et al. (2013), Hinkel et al. (2014) and Marshall (2015). This SES research, philosophical and epistemological shift to support an interdisciplinary approach in exploring the complex web of interacting entities and elements between the historical, social, political, geographical, ecological, agricultural and economic

interdependencies, reinforces the linking of social-ecological system condition to its social-economic outcome. Likewise, because the SESF set of variables is common to other theories, the findings derived from this analysis can be compared to similar contexts to evaluate the validity of the empirical evidence and results generated. Moreover, the different representative evidence on the interaction between governance systems, natural resource extraction, the consequences of oil mining externalities, and social-economic outcomes will be analysed sequentially using mixed-methodology to justify findings and discover unexplored natural resource system value management that are not often accounted for in mono-method data collection. From this analysis, the evidence can suggest where externalities appear to be extendable to the SES context. Externalities are costs or benefits imposed on someone or a group of persons by the action of others in the production process not reflected in the product prices (Pigou, 1920; Banzhaf, 2020). The costs or benefits generated are external to that bearing or benefiting individual or groups of persons, representing an overflowing cost that is not compensated or a spill over benefit that is not paid for.

Figure 2: Guideline for Operationalising the Social-Ecological Framework

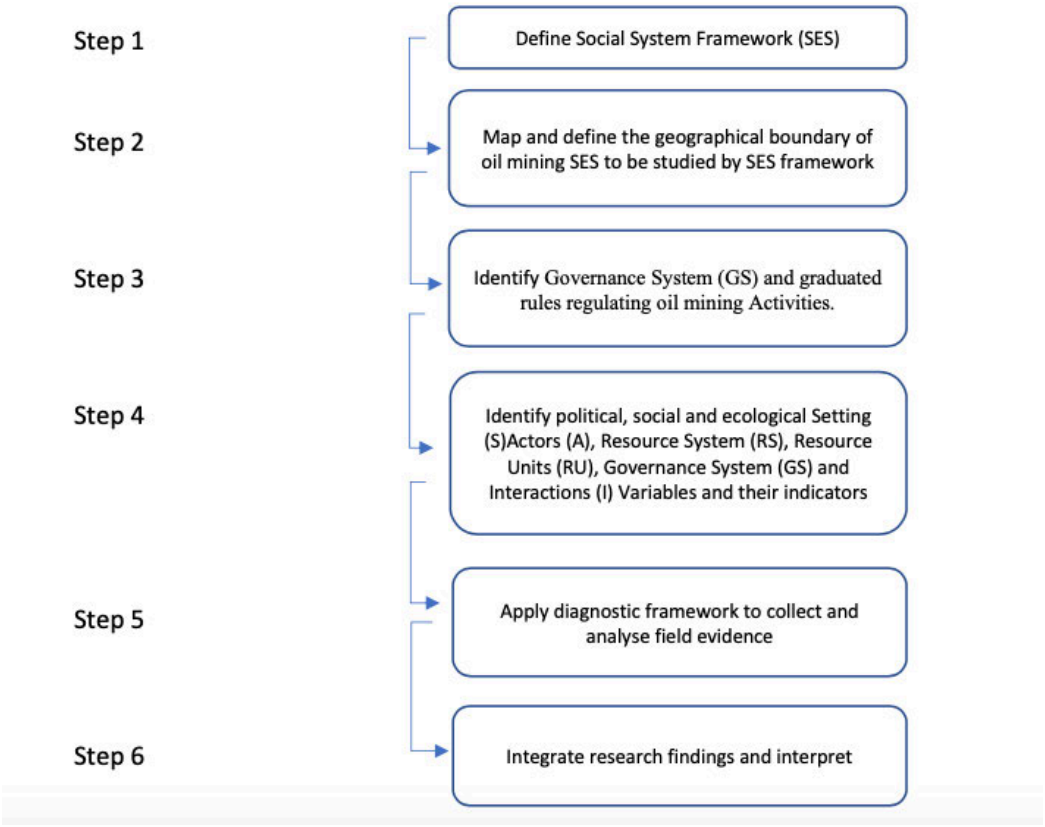


Figure 2 provides a step-by-step guideline from this stage of defining the McGinnis and Ostrom's (2014) SES framework up to the point of operationalising it for field survey exercises and data analysis, to integrating research findings for discussion and conclusion.

4.4.2 Mapping of the Social-Ecological System Variables

Table 1: Overview of Selected Theoretical Variables and Indicators for the Specificity of Field Survey Exercise Based on Modification of McGinnis and Ostrom's (2014) SES Framework

Variables (First Tier)	Traditional (Second Tier) Variables	Revised (Second Tier) Variables	Indicators (Capturable natural resource attributes from SESs assets)	Data Collection Source(s)
Setting	S1- Economic development S2 – Demographic trends S3 – Political stability S4 – Other governance systems S5 – Markets S6 – Media organizations S7 – Technology	S1-Social-economic development S2-Social stability S3-Governance system designated authority S3-Sustenance and livelihood S4-Household income		Semi-Structured Interviews Structured Survey Secondary Data

		S5-Micro-community economic condition		
RS (Resource System)	RS1 – Sector (e.g., water, forests, pasture, fish) RS2 – Clarity of system boundaries RS3 – Size of resource system RS4 – Human-constructed facilities RS5 – Productivity of system RS6 – Equilibrium properties RS7 – Predictability of system dynamics RS8 – Storage characteristics RS9 – Location	RS1*-Description of natural resource system assets. RS2*- Productivity of system RS3*- Human-constructed facilities RS4* Exposure of resource system to extreme weather conditions	• Size and quality of key geographical features. • Quantity and quality of food crops, fishery, livestock production and hunting. • Energy crops, including fuelwood and charcoal • wood as timber. • Condition of plant species for indigenous medicines. • Status of indigenous and • Traditional knowledge. • Number and level of perseveration of cultural sites in ecosystem. • Infrastructural status in community.	Semi-Structured Interviews Structured Survey Secondary Data
RU (Resource Unit)	RU1 – Resource unit mobility RU2 – Growth or replacement rate RU3 – Interaction among resource units RU4 – Economic value RU5 – Number of units RU6 – Distinctive characteristics RU7 – Spatial and temporal distribution	RU1*- Distinctive characteristics of Resource Units. RU2*- Productivity and Economic Potentials. RU3*- Access to resource units harvesting RU4*-Ratio of dependence on resource system/units	• Frequency of harvest of food, fuel, medicines, freshwater and aesthetic from ecosystem to meet basic needs. • Income (including from sale of harvest directly derivable from natural resource benefits). • Level of health and general wellbeing in human settlements. • Application of traditional knowledge for ecological system preservation. • Population using natural medicines. • Ratio of water use directly from freshwater system	Semi-Structured Interviews Structured Survey Secondary Data

			• Cost of alternative water source Frequency of visitors and average spend to tourism spots/cultural sites.	
I (Interaction)	I1 – Harvesting I2 – Information sharing I3 – Deliberation processes I4 – Conflicts I5 – Investment I6 – Lobbying I7 – Self-organizing I8 – Networking I9 – Monitoring I10 – Evaluative	I1* - Access to resource units harvesting. I2* - Available economic/ non-economic opportunities. I3* – Cordiality I4* - Conflictual Situations. I5*Resource System and Oil Fields Interface I6*Competition	• Natural resource system value extraction • Ratio of natural resource extraction for sustenance and livelihood • Turnover or gross profit from food crops, fisheries or hunting, livestock numbers and forestry sector. • Frequency and persistency of cultural celebrations. • Level of social trust in community leaderships.	Semi-Structured Interviews Structured Survey Secondary Data
(SA) Social Actors	A1 – Number of relevant actors A2 – Socioeconomic attributes A3 – History or past experiences A4 – Location A5 – Leadership/entrepreneurship A6 – Norms (trust-reciprocity)/social capital A7 – Knowledge of SES/mental models A8 – Importance of resource (dependence) A9 – Technologies available	A1* – Background of Actors A2* - History of natural resource use. A3* - Social wellbeing markers. A4* - Leadership Performance	• Revenue from natural resource benefits. • Strength of informal rule enforcement mechanisms. • Level of social trust in community leaderships. • Level of participation in decision making. • Population of oil industry personnel residing in contexts. • Employment rate • Health indices • Security concern • Incidents of social agitations	Semi-Structured Interviews Structured Survey Secondary Data
GS (Governance System)	GS1 – Government organizations GS2 – Nongovernment organizations GS3 – Network structure GS4 – Property-rights systems GS5 – Operational-choice	GS1* - Evidence of operational rule enforcement. GS2*- Participation in decision making. GS3*- Social infrastructure condition	• Size of population with direct property ownership. • Population in adequate housing. • Frequency of oil impact events on ecological systems	Semi-Structured Interviews Structured Survey Secondary Data

	rules GS6 – Collective-choice rules GS7 – Constitutional-choice rules GS8 – Monitoring and sanctioning rules	GS4* - Governance system performance.	• Risk of death, injury, or property loss from oil impact events. • Protection status of cultural sites and tourism spots. Population displaced by oil impact events. • Security condition	
(O) Outcome	O1 – Social performance measures (e.g., efficiency, equity, accountability, sustainability) O2 – Ecological performance measures (e.g., overharvested, resilience, biodiversity, sustainability) O3 – Externalities to other SESs	O1* – Social Economic Outcome		

Table 1 Description

This SES diagnostic framework represents the first attempt at mapping the variables (from first to third tier, including the revised third tier variable) for consideration. The mapped variables are interconnected with deductively selected indicators based on the peculiarity of the geographical system configuration, governance system and interaction to guide field survey exercise and the survey questions design (see Appendices 1 and 2). This table 1 describing the relationship between the SES variables and the supposed values accruable to the different social actors and their interaction to determine household income level and community economic condition.

4.5 Chapter Summary

This chapter explores the SES theory and provides guidelines on how it will be operationalised to interrogate the multiple level and scale of social actors' behaviour and interactions during the field survey exercise. Also, the literature provides the rationale for adopting the theoretical framework before proceeding to describe, analyse, map the SES

variables, and identify indicators to guide the diagnostic framework design for the field survey exercise (Nagel and Partelow, 2023). The study also modifies the SESF for examining the aspect of the research problem that have been overlooked in interpreting the economic problem of natural resource-dependent contexts. Although, studies that argued that the economic assessment of natural resource system value and its social-economic outcome can be scientifically complex because of the lack of a universally acceptable framework have been identified. This study by revising the SESF to design the diagnostic framework provide empirical guidelines to systematise the operationalisation of the theoretical framework to gather empirically valid evidence, data analysis results and findings that explains the research phenomenon. Therefore, this chapter improves on social-ecological system theory knowledge by suggesting the revision of some of the SES second and third tiers variables in alignment with selected indicators to guide field survey exercises, as well as advances the boundary of knowledge between the institution and social-ecological system theory by proposing to evaluate the effectiveness level of governance system capability and enforcement. Expectedly, more studies can apply the social-ecological system with unique refinement for future study of similar phenomena in other context.

Chapter 5

Methodology

5.1 Introduction

This chapter explicate the philosophical, epistemological underpinnings, and methodological approach in the study for this purpose of achieving research Objective 5. The ontology highlights the interrelatedness of philosophy, epistemology, and methodology by communicating the social reality from which the study is conducted and the appropriateness of this worldview for examining the research phenomenon. Also, the chapter describes the compatibility between the adopted philosophy, epistemology, and methodology to facilitate the design of survey instruments for field survey exercise. To ease understanding, the chapter is segmented into six sections. The first section briefly describes the research philosophy, epistemology, and paradigm. The second section discusses the research strategy, the methodological and methods preference, and ethical considerations. The third section briefly contextualises the SES framework for operationalisation to guide the field survey exercise. The fourth section describes the survey setting, sampling techniques, and ethical compliance approval that guides the administration of survey instruments. The fifth section details the field survey operationalisation of the survey instruments and the researcher's empirical judgement to navigate contextual limitations. The sixth section describes the data processing, analysis, validation, and generation of findings.

5.1.2 Research Objectives

This research study has focused on identifying gaps in the existing literature on the research phenomenon. Based on the many unresolved questions about Nigeria’s natural resource-dependent contexts and the many factors contributing to this challenge (Sala-i-

Martin and Subramanian, 2013). At present, this study suggests the existence of unexplored evidence veiling the understanding of SES challenges and opportunities impact on human sustenance and livelihoods around oil mining field and its overflow on other social-economic system. Whereas the theoretical linkages between institution structuring, natural resource system management, social-ecological system stewardship and social-economic outcome have been traced in previous chapters, this chapter design strategy to survey practical evidence that can explain the depth and broadness of the research problems. Therefore, the research objectives are:

5.1.3 Research Objectives

1. Building on research objectives 2, 3 and 4, to design and apply a purposive mixed-methods diagnostic framework for collecting three layers of field survey evidence to connects the research problem with research findings.

5.1.4 The Research Ontology

The philosophical standpoint fundamentally expresses the beliefs underpinning the conduct of this research exercise. For instance, ontology explicate assumptions made about the nature of social reality based on what exists, its description and the interactive structures of its configuration. Thus, ontological assumptions explain what we believe constitutes social reality" (Blaikie, 2000, p. 8). From this reasoning, the SES theory represents the interrelationship between humans and the ecological system in a unified natural embeddedness (Ostrom, 2009). This implies that the social-ecological system only exists in human experiences and perception of interacting with their ecological system in everyday real-life reality (McGinnis and Ostrom, 2014). Accordingly, the nature of reality from which the study explores the research phenomenon is multiple social realities that signify the Pragmatist's philosophy.

5.1.5 The Pragmatist's Philosophy

The pragmatist's instrumentalism holds that "thought, thinking, inquiry, and ideas are instruments of solving practical human problems" (Dewey, 1977, p. 50). This pragmatist's philosophical thinking favours an approach that generates knowledge from human relationships within their natural environment. However, pragmatism rejects the transcendental aspect that is beyond scientific scrutiny (Hildebrand, 2004). This implies that in a Pragmatist's instrumentalism, knowledge is not generated from an external and independent reality. Rather, knowledge is constructed by actively participating in real life through an analytical process of evidence from human experience in the natural environment. However, Ihenjirika (2021) argued that without transcendental knowledge, pragmatism treats humans as mere empirical objects without value beyond scientific inquiry. Likewise, Popper (2005) argued that Pragmatist instrumentalism seems misleading because it preoccupies with what works rather than what is true or whether the knowledge is right or wrong. However, William James (1904) underscored that the reality of experience bridges the segregation of the object and subject of knowledge in scientific inquiry. Thus, the researcher, as the subject of scientific inquiry is enmeshed in the empirical process of making informed judgements about instruments through which the empirical object will be interrogated. In this situation, the researcher as subject and the social perspective as object of the inquiry are integrated in the pragmatist study of resolving a problematic situation. Unlike traditional philosophic thinking that separates the subject and object of inquiry when exploring complex social phenomena, the evidence and result of study from pragmatist standpoint are replete with contextual breadth, depth, and richness. Therefore, the rationale for adopting the Pragmatist's instrumentalist philosophy is to transit the research exercise from an abductive

and deductive reasoning towards a state of applying empirical tools to systematically examine theoretical assumptions for valid claims.

5.1.6 Considerations of the Research Context

This study explores Nigeria's social-economic problem from the SES perspective as its core aim. The ontological consideration for studying a phenomenon intersecting people, the ecological system, natural resource management and the social-economic outcome is the pragmatist's instrumentalism philosophy (Dewey, 1938). Besides, the 'reality' of the SES exists in human real-life interaction with the ecological system based on their five senses. This implies that the interpretations of the research phenomenon cannot exist independently of the contextual human senses and perception of the environment. Moreover, the reality of the research phenomenon is not expected to be static, but is subject to continuous revisions and analysis for knowledge discovery. For these reasons, the pragmatist's instrumentalist perspective provides the appropriate reality for interrogating the phenomenon.

5.1.7 The Epistemology of Study

Epistemology describes the approach that defines, constitutes, and underlies how knowledge claims are made, its validity, and transferability in a scientific inquiry. Crotty (2003) defines epistemology as the theory of knowledge, and categorises the concept into objectivism and subjectivism. Objectivism argues that knowledge is derived from measured and analysed facts independent of human influence. Subjectivism proposes that knowledge is humanly generated based on the meanings people attribute to their natural world (Saunders et al., 2009). However, whether with respect to objectivism or subjectivism, to Dewey (1938), knowledge represents the end of inquiry with an independent meaning outside the inquiry (Boyles, 2006). This implies that this study underpinned by the Pragmatist's philosophical foundation, by interrogating and analysing multiple human

experiences in their natural ecological can merge both subjectivity and objectivity elements to make empirical valid claims to advance knowledge about the research problem. Thus, this research study evolves to systemised transformation of human practical experiences and perceptions through an empirical rigour into a determinate knowledge that defines the research problem.

5.1.8 The Research Paradigm

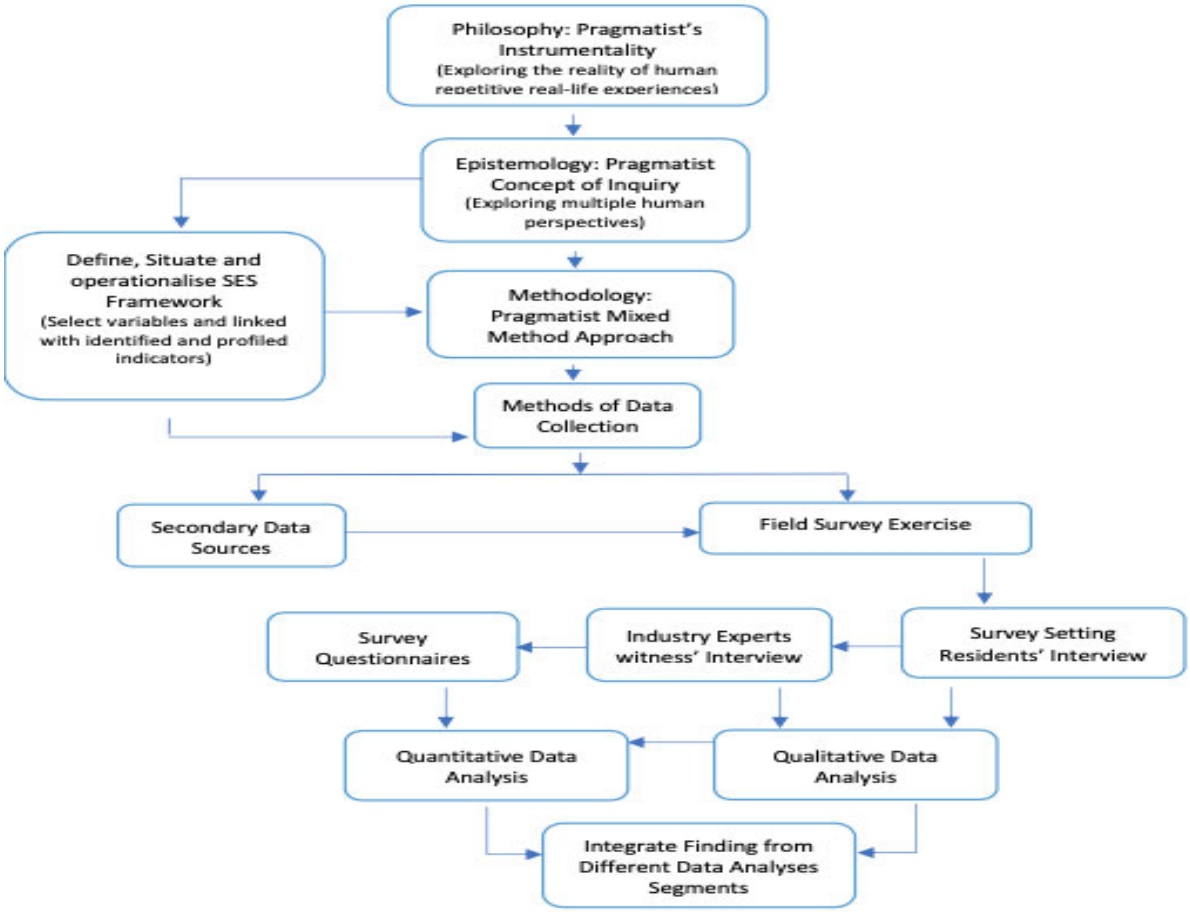
A research paradigm comprises a set of beliefs and values that guide and are foundational to all aspects of the research strategy, including the aim of the study, research questions, means of measurement, and analysis. Also, the term research paradigm is sometimes applied to describe 'overarching philosophical systems denoting particular ontologies, epistemologies, and methodologies' (Denzin and Lincoln, 2013: 11). Thus, based on the understanding of the basic foundations of traditional science, this study situates pragmatism as the nature of reality to guide the research paradigm.

5.2 Research Strategy

In response to Objective 5, this research strategy provides the rationale for applying the research theory to guide the methodology design and demonstrate a clear connection between the research problem, survey evidence and finding. A qualitative mixed-method approach that combines qualitative and quantitative survey techniques is proposed for collecting, analysing, field survey evidence and interpreting data analysis result. Therefore, this innovatively designed qualitative-centred SESF diagnostic framework will sequentially gather the multiple human perspectives in the SES around the oil mining context (see Figure 3). This sequential approach (Creswell et al., 2017) means that a semi-structured interview will collect the data from a purposively sampled population from the first and second layers of field evidence before using this evidence to guide the design survey questionnaire

administered randomly (see Figure 3 and Table 2). The semi-structured interviews will also guide the data analysis process to generate insight for designing the survey questionnaire before integration of data analysis result for comprehensive interpretation. The rationale for adopting the mixed-methods approach is to avoid relying on a singular survey instrument for examining the complex interactions between biodiversity of human, animal and plants life with variations among and across genes, species and functional traits in the ecological system. Likewise, by applying mixed-methods, this study generates objective and rich knowledge about the research problem by applying the results from the qualitative method to guide the design of the quantitative methods questionnaire for penetrative insights beyond previous theories and viewpoints interpretations.

Figure 3: Interconnecting the Social-Ecological System Framework (From Ontology to Methods)



5.2.1 Mixed Methodology Preference

The methodology describes the survey technique and application for field evidence collection. By integrating the qualitative and quantitative methodologies for the field survey exercise, the research expects to generate broad and rich evidence for data analysis. Also, the preference for mixed methodology is to, aside from achieving complementarity, corroboration, and confirmation of result and findings (Tashakkori and Teddlie, 2008), blend the elements of subjectivity associated with qualitative study with objectivity for valid empirical inference. Although Sale et al. (2002) opined that confirmation is a poor motivation for mixed-method research because different data types produce distinctive knowledge. Nonetheless, this study proposes also to achieve the scale and depth where the qualitative evidence is strengthened by the quantitative evidence. Besides, the two data sources are not just intended to complement, but also corroborating each other by tracing the relationships between the different research findings. Additionally, by applying mixed methodology, this study can interrogate the top-to-bottom, cross-cutting, and bottom-to-top evidence of the research problem. Thus, through a carefully guided synthesis of the research philosophy, epistemology, methodology, and method applications, this SESF guidelines in Figure 2 is operationalised in the visualisation of the research strategy (Figure 3) to justify the epistemology (please see Tables 2 and 3).

Table 2: Illustration of Research Strategy Framework

Orientation	**Quantitative**	**Qualitative**
Pragmatist Instrumentalism (Dewey, 1938)	Social reality of the natural world. Truth is constant. Practical human experiences measured with controllable parameters as object of study.	Social reality of the natural world. Truth is fluid, requiring continual assessment of human experiences based on evidence. Researcher as subjective of study
Research Purpose	Apply the quantitative method to collect field survey evidence that generate objective empirical results for complementing qualitative findings.	Apply the qualitative method to interrogate and analyse the breadth, depth and rich contextual perception about the research phenomenon.
Research Methodology (Creswell and Plano Clark, 2011)	Deductive in nature.	Inductive and abductive in nature.
Transformative Sequential Sampling Methods (Creswell et al, 2009).	Random probability sampling (Tashokkori and Teddlie, 2003).	Purposively and snowball sampling (Johnson and Onwuegbuzie 2004).
Methods of Data Collection Instruments (Creswell and Plano Clark, 2007; Nagel and Partelow, 2022) (see Figures 6 and 8)	Survey using closed-ended questions.	Open-ended semi-structured interview on subject experts and local communities' respondents.
Data Analysis Techniques (see Figure 9) Onwuegbuzie and Combs, 2011, Braun and Clarke, 2006; Corbin and Strauss, 2008	Test theories comprising variables measured numerically and analysed statistically	Analyse words, sentences and paragraphs to map patterns and generate themes
Generalisability (Teddlie and Tashakkori, 2009; Ferguson, 2004; Smith, 2018)	External validity and transferability of findings from inferential analysis of the representative survey evidence from social perspectives.	Naturalistic and analytical generalisation from gathering survey interview evidence of social perspectives.

5.2.2 Research Methods

The research methods are the empirical instruments applied in field survey exercises. However, the choice of methods in this study is to add penetrative insight in the first and second segments of qualitative data collection while controlling any form of subjectivity through results from the third segment of randomly distributed questionnaires to a larger sample population for more credible result (see Table 2, 3 and 4, Figures 3, 6 and 8). However, data collection in this study combines the distinctive strengths of achieving depth and richness of evidence in the qualitative segment to reinforce the broadness of the quantitative

segment (Creswell and Plano Clark, 2011). Thus, this study combines two layers of semi-structured interviews and one structured questionnaire that provide a holistic perspective about the research problem (Teddlie and Tashakkori, 2009). Also, because the administration of survey instruments will systematically trace the linkages between the research philosophy, epistemology, and methodology, the field survey and data analysis process is designed to be transparent, trustworthy, dependable, and thus transferable for future studies.

Table 3:Alighnment Research Objective and Research Methods

Research Objectives	Research Methods (Onwuegbuzie and Combs, 2011; Collier, 1998; Creswell and Plano Clark 2011; Teddlie and Tashakkori, 2009; Leslie et al 2015)		
	Literature Review	Survey (Semi Structured Interview 1 and 2)	Survey Questionnaires
• Building on research Objectives 2, 3 and 4, to design and apply a purposive mixed-methods diagnostic framework for collecting three layers of field survey evidence that connects the research problems with research findings.	X	X	X

Table 4:Alignment of Field Survey Instrument and Sources of Evidence

Mixed Methods **Data Collection Instrument** (Creswell, Plano Clark 2007; Nagel and Partelow, 2022)	**Secondary Data Source**	**Qualitative**	**Quantitative**	**Actions**
Desk research (De Voc et al, 2019).	Journals, government publications and multilateral agencies think-tank research documents are explored.			To collect context-based dataset for background knowledge social-actors interaction in the SES within oil mining context.
Semi-Structured Interview (Corbin and Strauss, 2008)		Open-ended questions interview administered remotely on community social actors using open-ended interview questions administered remotely.		Community social actors that includes local indigenes fishermen/women, farmers, local traders, day-hired labourers, building contractors, electricians, caterers, oil companies' employees and different categories of community leaderships; and 6 oil industry experts' witness from oil employees, geology lecturer and consultants serving different oil organisations to provide survey evidence. Purposive and snowball sampling given the demographic mismatch around rural communities.
Structured Interview (Onwuegbuzie and Combs, 2011)			Administration of Questionnaires.	Respondents to participate in the identical set of closed-ended questions administered remotely.

5.2.3 Rationale for a Transformational Sequential Data Collection and Analysis

The research design develops the data collection and analysis framework to generate credible results and findings for the purpose of achieving the research aim and Objective 5. This transformative sequential research applies a three-stage data gathering process to interconnect the research problem, survey evidence, data analysis results to deepen and enrich the research findings while controlling the subjectivity of the different field evidences (Creswell et al., 2017). Likewise, considering that the survey collects evidence from three different sample populations, it creates opportunities for data comparability, corroboration and confirmation of the human perspective, with possible revision to standardise the frameworks over time. Besides this transformative sequential approach underlined by pragmatic inquisitiveness, goes beyond interpreting the research knowledge to design a framework for studying future phenomena in similar contexts. Thus, the research strategy is not merely an assemblage of data collection methods; rather, this transformative sequential mixed-methodology designs a diagnostic framework that advances the social-ecological system framework to systematically examine and provide credible evidence for explain the research problem (McGinnis and Ostrom, 2014).

5.2.4 Demographic and Geographical Description of Field Survey Context

Out of the total land mass of Nigeria's 923,768 square kilometres, the Niger Delta geography where this study will be conducted occupies 84,616 square kilometres (NBS, 2013). The survey setting comprises six south-south sub-nation states that endowed with rich natural biodiversity, minerals, and hydrocarbon resources that supports humans, communities of different terrestrial and aquatic life species. This geography delineating the survey setting lies in the middle of the coastal belt between the borders of Cameroun, Nigeria's south-western states overlooking the Bight of Benin. Traversing the tropical

rainforest, the inland freshwater coastal and marine ecosystem with creeks, lakes, rivers, swamps, and mangrove forest all flowing into the Atlantic Ocean through the Bight of Benin (see Figure 4). Although this tropical rainforest is mostly characterised by very tall trees with large trunk, the geography is susceptible to flooding events. There is the wet season with lower temperatures and the dry season with relatively higher temperatures that rarely exceed 34 degrees Celsius. This region provides shelter to a heterogeneous population of about 28.8 million comprising over 40 ethnic groups distinguished by about 120 languages and dialects living in rural and urban settlements with many small island communities are interconnected by wetlands. (NBS, 2024). About 48 per cent of households source their livelihood from the natural resources system, such as fertile landscapes, wetlands, and forest formations; another 10 per cent depend on informal services; and the other 17 per cent and 7 per cent depend mostly on trading and education/health services, respectively (NBS 2013). The region is famous for the over 40 billion barrels of crude oil and 5.29 trillion cubic meters of natural gas reserves deposits extracted from 323 onshore and offshore developed fields interconnected through pipelines spanning 5,284 km across by 265 production processing stations and 8 crude oil/condensates and natural gas liquids export terminals (NNPC, 2015). With this intensity of oil exploration and infrastructural connectivity, this geography describes a unique social-ecological system within the oil mining context (see Figure 5). Comprehending the demography, territory, and circumstance of interacting with the SES, the study provides insight into the scale, scope, and limitations that might influence survey findings and their generalisability.

Figure 4: Map of Nigeria



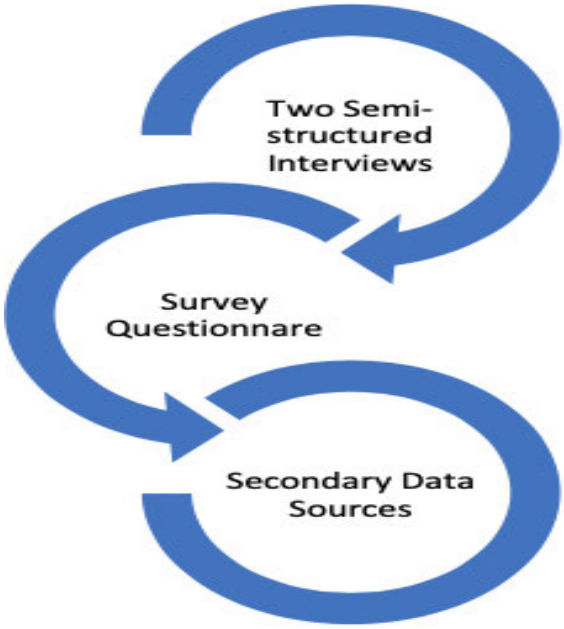
Source:
https://upload.wikimedia.org/wikipedia/commons/5/56/Political_map_of_Nigeria.svg
United Nations Cartographic Section, Public domain, via Wikimedia Commons

5.3 Diagnostic Framework Design and Application

Guided by the Pragmatist's Instrumentalism and social-ecological system framework (SESF), this study designs a mixed-methods diagnostic framework for field survey exercise, data analysis, and presentation of findings. For example, Pragmatist instrumentalism supports the collection of practical human experience based on their relationship with the natural environment (Dewey, 1938), while the SES Framework (McGinnis and Ostrom, 2014)

examines common-pool natural resource systems where multiple social actors interact at different scales and layers for sustenance and livelihoods. Thus, this diagnostic framework helps connect the research aim, objectives, theory, and methodology to the research problem with practical evidence, results and findings. Then this study maps the first and second-tier SESF variables and identifies indicators to guide field survey exercise (Nagel and Partelow, 2022). However, the empirical inquisitiveness of this study facilitates the modification of the McGinnis and Ostrom's (2014) SESF with the addition of some context-specific variables according to the geographical configuration and socially constructed nature of the survey setting. Also, the sample population selection criteria will be purposive, before applying sequential technique to interrogate the different layers of survey respondents (see Figure 5) (Agrawal, 2003). This suggest that the operationalisation of the diagnostic framework will generate different layer of survey evidence from multiple perspectives. However, the survey evidence will be integrated to generate research finding with depth, richness and broadness. The whole essence of this explanation is to illustrate the usefulness and robustness of the SESF.

Figure 5: Interaction of Data Sources and Collection Technique



5.3.1 The Diagnostic Framework Design and the SES Framework Operationalisation

In response to Objective 4, the study mapped the SESF variables related to the research problem guided by theoretical analysis, then identifies and select indicators to guide field evidence based on the research focus and researcher's knowledge of Ostrom and McGinnis's (2014) SES theory. The variables were nested underneath the six first-tier variables and the second and third-tier variables identified will be selected to design the survey questions from the Table 5 based on the indicators that will be tracked from the field survey exercise. The semi-structured interview is designed with predefined open questions but is guided verbally by the researcher empirical judgement. The evidence from field survey according to selected indicators are profiled designing a code dictionary for data analysis based on the SESF categorisation. However, secondary evidence from sources such as books, journal articles, daily newspapers, government reports, articles, seminar papers, PhD theses, etc will supplement the primary evidence. As a diagnostic framework guided by a sequential mixed-methods, survey evidence from the qualitative segment will generate insights to guide

the third phase of quantitative data collection (Creswell et al., 2017). However, following the COVID-19 pandemic restriction, the choice survey technique was revised to collect data remotely (Rugg and Petre, 2007). Thus, survey instruments will be administered using GSM-enabled telephone services and online platforms dependent on internet technology. Semi-structured interviews will be administered to respondents selected from three communities in the Niger Delta. The Niger Delta region is purposively selected for this survey because of contributory factors to the Nigerian economy as an important oil production geography and ecologically vibrant region (UNDP, 2006).

Table 5: Revised McGinnis and Ostrom's (2014) SESF Variables and Data Collection Source for Guiding Field Survey Exercise

Variables (First Tier)	Traditional (Second Tier) Variables	Revised (Third Tier) Variables	Data Collection Source(s)
Setting	S1- Economic development S2 – Demographic trends S3 – Political stability S4 – Other governance systems S5 – Markets	S1-Social-economic outcome S2-Social stability S3-Governance system designated authority S3-Sustenance and livelihood sources S4-Household income S5-Micro-community economic condition	Semi-Structured Interviews Structured Survey Secondary Data
RS (Resource System)	RS1 – Sector (e.g., water, forests, pasture, fish) RS2 – Clarity of system boundaries RS3 – Size of resource system RS4 – Human-constructed facilities RS5 – Productivity of system RS6 –Storage characteristics	RS1*-Description of natural resource system assets. RS2*- Productivity of system RS3*- Human-constructed facilities RS4* Exposure of resource system to extreme weather conditions	Semi-Structured Interviews Structured Survey Secondary Data
RU (Resource Unit)	RU1 – Resource unit mobility RU2 – Growth or replacement rate RU3 – Ratio of Dependency RU4 – Economic value RU5 – Number of units RU6 – Distinctive characteristics	RU1*- Distinctive characteristics of Resource Units. RU2*- Productivity and Economic Potentials. RU3*- Access to resource units harvesting RU4*-Ratio of dependence on resource system/units	Semi-Structured Interviews Structured Survey Secondary Data
I (Interaction)	I1 – Harvesting I2 – Information sharing I3 – Social Mediation	I1* - Access to resource units harvesting.	Semi-Structured Interviews Structured Survey

	I4 – Investment I5 – Self-organizing I6 – Monitoring	I2* - Available economic/ non-economic opportunities. I3* – Cordiality I4* - Conflictual Situations. I5*Resource System and Oil Fields Interface I6*Competition	Secondary Data
(SA) Social Actors	A1 – Number of relevant actors A2 – Social-economic attributes A3 – History or past experiences A4 – Leadership/entrepreneurship A5 – Knowledge of SES A6 – Importance of resource (dependence)	A1* – Background of Actors A2* - History of natural resource use. A3* - Social wellbeing markers. A4* - Leadership Performance	Semi-Structured Interviews Structured Survey Secondary Data
GS (Governance System)	GS1 – Government organizations GS2 – Property-rights systems GS3 – Operational rules GS4 – Collective-choice rules GS5 – Monitoring and sanctioning rules	GS1* - Evidence of operational rule enforcement. GS2*- Participation in decision making. GS3*- Social infrastructure condition GS4* - Governance system performance.	Semi-Structured Interviews Structured Survey Secondary Data
(O) Outcome	O1 – Social performance measures (e.g., efficiency, equity, accountability, sustainability) O2 – Ecological performance measures (e.g., overharvested, resilience, biodiversity, sustainability) O3-Governance System Performance. (e.g. capability in operational rule enforcement) O4– Economic system performance (e.g. individual, income, household income, and local communities' economic condition)	O1* – Social Economic Outcome O2* - Effectiveness of Institutions	

This Table 5 describing the relationship between the SES variables to track the assumed values accruable natural resource values to the different social actors based on their interaction to determine household income level and community economic condition. The table represents mapped variables (from first to third tier variables, including the revised variables) based on the SESF, interconnected with proposed sourced of tracking indicators (variable attributes) to measure and compare the different level of categories of variables. This table containing the mapped variables is also applied to guide the code analysis of fields survey evidence to reflect

the peculiarity of the geographical system configuration, governance system influence on the social interaction in the survey settings. First, this study identified and reviewed literature recommending or referencing other papers operationalising social-ecological system conceptual frameworks in the Ecology and Society journal. Also, the classification systems incorporated by us were based on those by Millennium Ecosystem Assessment, Ecosystems and Human Well-being (M.E.A., 2005) global assessment report on biodiversity and ecosystem services (IPBES, 2019) and Ecosystem Assessment Framework (Ash et al. 2010) publications which are co-developed and widely applied for ecosystem sustainability valuation in empirical science. Whilst the ecosystem assessment publications are considered exhaustive, for guiding the identification of context-specific variables the study used the UNEP report (2011) and Sentamu et al study (2023) on the ecosystem condition in Ogoniland. Thus, the preliminary set of variables was mapped in Table 1, revised in this Table 5 reflects the integrative conceptual framework developed. However, the structure of the mapped variables can only be validated through the application of the framework for field survey and data analysis (see Ash et al. 2010). Nevertheless, this explication of the modification of the SESF at the local scale of survey setting around oilfields should suggest that the process is straightforward without complexities in understanding and standardising the variables integrated for this survey. Thus, this empirical science will continually monitor the interaction within SES under study toward assessing the micro-scale to its macro impact in the social-economic system.

5.4 Field Survey Exercise

5.4.1 Field Survey Setting Selection

The importance of this study explicated in Chapter 1 have influenced the direction of this research exploring the SES in the survey setting. The field survey exercise collects practical

and diverse evidence from human perception based on social actors' interaction with social-ecological systems with defined governance systems capability and enforcement. Thus, a survey setting interconnecting oil mining and installations fields, SESs, and households, communities was selected for the field survey exercise to ensure that the perspective of the interactions oil mining, exploration of natural resource-based sustenance and livelihood source are sufficiently capture for data analysis. In the first phase, In the first phase, the whole country is divided into administrative regions. Then the south-south geopolitical region where the core six Niger Delta sub-nation states are located out of 10 states in Nigeria where oil is explored in commercial quantity were grouped as the survey setting for data collection. Akwa Ibom, Rivers, and Bayelsa State were selected randomly to identify communities for a semi-structured interview survey. From the selected states (Akwa Ibom, Rivers, and Bayelsa), three local government areas—Ibeno, Gokana (Ogoniland), and Twon Brass—were purposively selected because of the historical legacy of oil mining for the semi-structured interview (Agrawal, 2003). For emphasis, Ibeno, Ogoniland, and Twon Brass Kingdom host oil multinationals and several indigenous companies with a network of oil installations amidst pre-existing human settlements. However, the random selection of survey setting in this qualitative study may suggest that survey evidence from other communities with widely publicised intensity of oil mining consequences will not be analysed in this study. However, structured survey questionnaires were administered over a wider geographical coverage across the urban and rural areas across the six oil-producing states (Edo, Delta, Bayelsa, Rivers, Akwa Ibom, and Cross River) in south-south Nigeria and Lagos, where the administrative head offices of almost all the oil mining companies are located, and Abuja, the seat of political power, where the headquarters of the Ministry of Petroleum Resources, the Ministry of Environments, and their supporting regulatory enforcement agencies. This

approach ensured that any perspective of any social group missed in the first and second survey interview phase, it could be captured through the survey questionnaire.

5.4.2 Pathway to Survey Setting Access and Trust Building

The process of research ethics compliance and risk assessment approvals identified risks for which control plans were made. As part of the risk control measures, the field survey plans considered a trust-building approach for a hitch-free field survey exercise. To navigate the local community gatekeeping, trust building and collection of representative evidence, the researcher engagement strategy started by approaching the universities located around survey setting to seek students and lecturers from identified communities who could serve as volunteer influencers with their community elders in the survey setting. These influencers were responsible for referring the researcher and communicating the research aim and objectives to the local community leadership. For Ibeno precisely, once the researcher was introduced to the leadership, a token amount of money was requested for light refreshments to entertain the elders gathered to deliberate on the survey exercise. After the initial pleasantries and introductions, the researcher was invited to present the aim and objectives of the survey exercise, specific clarifications on their personal safety concerns and anonymity respondent using the field survey information sheet.

On the completion of the presentation, the ethics guide that included the contact detail of project supervisors and ethic committee chair was communicated for the transparency of the survey exercise. This approach to social engagement was able to build trust and the leaders obliged to participate in the empirical exercise. They immediately nominated the first survey respondent (a retired female soldier) to participate in the interview in the presence of the gathering. However, considering other community leaders present in the gathering, the researcher was uncertain why a female and military retiree was

nominated to participate first or whether it was based on volunteer basis. Nevertheless, the conclusion of this first survey interview in line with brief presentation to the elders immediately reinforced confirmed that the survey interview questions were straightforward, not controversial, nor intended to expose the community to any harm. This community engagement process commenced a three-way communication between the local facilitator, a representative of the local community leadership, and the researcher who supported the survey interview exercise for the first set of n=5 respondents over two weeks. Nevertheless, the stakeholder engagement exercise revealed a structured community gatekeeping approach for engaging external actors because the influence confirmed that if the survey exercise has not been approved by the elder's council, then she would have discontinued her support. But, level of social gatekeeping could also mean that the council of elders in the community can hijack the exercise to shield the evidence of the natural of the local leadership performance as custodian of informal institutions.

For Ogoniland and the Twon Brass Kingdom, the engagement and trust building approaches were slightly different. The community influencers first participated in the interviews before recruiting other survey respondents to participate in the survey. Once satisfied with the credibility of the exercise, the other respondents were considered based on the pre-selection criteria. However, to achieve diversity of evidence, attempts were made to recruit resident survey respondents to participate in the interview through their social media handles, which was partially successful. Different community non-governmental organisations (NGOs) through a simple Google search were approached to facilitate access to community stakeholders for field survey evidence balancing. Out of the four NGOs contacted, two of them were through emails or X social (formally Twitter) direct messages. Nevertheless, only a female NGO leader coordinating over a thousand of local community women in

mangrove forest remediation agreed and participated in the survey interview. Thus, accessing survey interview respondent through online platform was partially successful. Nonetheless, the stakeholder engagement and trust building exercise were seemed more challenging in Ogoniland may be because of the mistrust for external actors based on their previous conflictual experiences with security operatives from government and oil corporations (see Martinez Allier, 2014). This difficulty in accessing respondents in Ogoniland necessitated the adoption of snowball sampling to reach more respondents within the survey timeline, which eventually eased reaching the specific sampled populations for the study.

Additionally, some leaders did not want to be treated as research objects because they complained that after engaging in field surveys previously, those researchers never returned. However, once the leaders were reassured that their surveyed practical experience was invaluable evidence for knowledge-building and analysis, they committed to the exercise. Although, engaging the people of Ibeno and Twon Brass kingdom who were more receptive and friendlier, yet survey evidence from Ogoniland corroborated evidence from Twon Brass and Ibeno. However, a male local university lecturer from the community for want of complete anonymity only consented to participate in the online survey questionnaire. Nevertheless, stakeholder engagement understood the power dynamics in the communities, and the pattern of informal relationships within the context to guide the survey interview process in collecting representative evidence. While this field survey experience provides context-specific evidence to this study, it is important to note that stakeholder engagement is important aspect of the field survey exercise to achieve representativeness and diversity of survey interview evidence that provide equal opportunity to capture every valid perspective on the research phenomenon as long as they were willing and met the criteria for participation. Thus, studies surveying rural communities could prepare for various forms of

social gatekeeping by design a purposeful stakeholders engagement geared towards trust building.

5.4.3 Criteria for Selection of Survey Interview Respondents

Stakeholder Mapping

The stakeholder mapping categorised the different sample populations into;

1. Local Communities Respondent: local chiefs, family heads, women social group leaders, youth leaders, students, indigenous people, residents, and civil servants.
2. The selected survey respondent as part of the sample population considered respondents' real-life experiences for over 5 years, their availability, and their willingness to participate in the field survey.
3. Oil Industry Experts (Key Witness): employees with oil exploration with specialised knowledge in the health, safety, and environment, community relationships, and sustainable development job description.
4. University lecturers teaching environmental studies, applied ecology, or geology interfacing with the different layers of oil industry actors and local communities either on consultancy basis or education survey exercise.
5. Government regulatory and enforcement personnel in the oil mining industry.
6. All expert witness should have a minimum of 10 years of working or consulting experience for oil exploration and production companies around the survey context, their availability, and their willingness to participate in the field survey.

5.4.4 Sampling

Sampling is a subsection of a larger social group with common characteristics that this research has identified to survey. As a fall-out of the stakeholder mapping, the field survey exercise considers factors such as the research phenomenon, research strategy, scope,

theoretical framework variables and indicators, social features of the population of interest, geographical location, value of respondents' evidence, and data saturation where interview evidence from subsequent respondents seem repetitive with no new addition. The sample population considers individuals' real-life experience in the SES based on a minimum of 5 years of successive residence for the qualitative survey. The purpose of the sampling method was to ensure that people with real-practical experience from interacting with oil mining in the ecological system, able and willing to communicate their experiences, were identified and selected for the survey interviews. Likewise, demographic features such as population size, gender, and age were considered for inclusivity (Denzin and Lincoln 2005). However, when the field survey exercise encountered challenges with accessing interview respondents because of the pre-identified risk assessment challenge, snowball sampling was considered and adopted. This adjustment to navigate access to the survey respondent problem was a faster remedy amidst the time constraints because the sampling method could vouch for the representativeness and trustworthiness of evidence once survey respondents met the pre-selection sample population criteria.

Adopting the non-random snowball sampling method amidst the field survey exercise meant that the researcher exercised more subjective judgement because the selection considered respondents with practical experience who could communicate in their language of understanding and were willing to participate. Overall, the purposive sampling meant that the pre-identified population had the perspectives and insights that provided representative evidence of the social reality in the survey setting. Nevertheless, survey interview evidence from purposive and snowball sample populations from real-life experiences and the events in complex social-ecological systems may be limited to naturalistic generalisability (Smith, 2018). However, the exercise did deliver contextually meaningful relevant evidence with

depth and breadth that can provide immediate practical insight for policy design. Besides evaluating for statistically significant effects for broader generalisability to similar sampled populations, the sequential sampling technique complemented purposive sampling with probability sampling (Lesko et al, 2018). This technique meant that more representative evidence of social actors that are grossly dependent on the natural resource system for sustenance and livelihoods was collected. Evidence from the quantitative segment designed with insights from the purposive sampled population provides complementarity and corroboration to blend the elements of subjectivity and objectivity (Tashakkori and Creswell, 2007).

5.4.5 Ethical Considerations and Clearance

To ensure rigour and validity of survey evidence the University of Gloucestershire ethics compliance requirement for an acceptable ethical practice, this study conducted the field survey according to acceptable scientific standards by ensuring survey respondents understood the research information, purpose, voluntarily participated, obtained informed consent (see Appendix 5), provided the participants with the right to withdraw at any time, protected the research respondent's privacy, and ensured anonymity. For emphasis, ethical issues according to the university guidelines as summarised below were considered.

- Avoidance of any form of harm to the respondents.
- Respecting the respondents' dignity.
- Ensuring the confidentiality of data.
- Protecting the respondents' anonymity.
- Avoiding deception by clarifying the research and the aims.

In this study, ethical compliance approval for the field survey exercise was processed and obtained from the University of Gloucestershire in line with the ethics guideline (see Appendix

6) https://www.glos.ac.uk/information/knowledge-base/research-ethics-a-handbook-of-%20principles-and-procedures/ (UOG, 2024). Thus, the research information datasheet was audibly read out to all survey respondents to understand the purpose before the commencement of the survey interview before survey respondents were asked for verbal consent (see Appendices 5 and 6). Reading the information datasheet often lasted an average of 6 minutes. Consent based on the context of the information datasheet was obtained verbally as captured in the audio recordings. Sometimes, interview sessions were rescheduled to accommodate survey respondents' convenience. In summary, the research study complied with the required University of Gloucestershire ethical compliance standards and confirmed that all field survey evidence for generating data analysis results and research findings were ethical compliant.

Pilot Study

Once the research strategy obtained all administrative approvals, the survey questions were tested through the pilot phase to check the feasibility of the survey instruments and its limitations. A pilot study was remotely conducted in two communities, Agudama in Rivers State and Twon Brass in Bayelsa State, between May and June 2022 to investigate and guide the main field study exercise. During the pilot study, semi-structured interviews were administered remotely via GSM telephone to four respondents, two community respondents, and two industry expert witnesses to test the diagnostic framework as an empirical measurement instrument. Although the initial concern was experienced because of survey respondent attrition. However, the pilot study provided insight for the revision of some survey questions for easy comprehension, the sequence of arrangements, and the administration strategy as well as the need for stakeholder's engagement and trust building. Besides, the pilot exercise guided the adjustment of survey respondents' selection

criteria, scheduling and time allocated for each session, and the level of technology preparedness and telecommunication exercise efficiency. Thus, the research pilot provided the researcher with the fore-knowledge of field survey challenges and how to plan for them during the field survey exercise.

5.4.6 First Phase of Interview Process – Local Community Residents

5.4.6.1 Community Stakeholders Survey Respondents recruitment

Drawing from the diagnostic framework design, stakeholders mapping and engagement and pilot data collection phase, field evidence was collected by administering three layers of survey instruments (interviews administered to two sample populations and a survey questionnaire). Interview respondents were sourced based on stakeholder mapping from individuals and social groups with links to contexts from social media, religious organisations, industry experts, higher education lecturers' referrals, and local NGOs. Each survey respondent was identified by name, gender, community position, and allotted codes (Palinkas et al., 2015). The survey respondents included private individuals, community elders and leaders, adult students, and representatives of nature-orientated NGOs. The interview questions (see Appendix 1) were structured along the logic of the social actors' interaction in the survey setting about the research phenomenon. This implies that whether the respondents were men, women or youths, community leaders, artisans, farmers, fishermen(women) or employed in the oil industry, as long as they resided in, or sourced sustenance or livelihood from the communities for up to five years, they were considered as part of the sampled population.

Interviews were conducted remotely, allowing the respondents to select dates and times based on their schedules (Denzin and Lincoln, 2018). The first phase of the semi-structured interview started on June 19, 2023. A total of n=24 interviews were conducted

with respondents assigned a code for anonymity based on their geography of residence and sequence of interviews: Ibeno (IAN01 to IAN11), Ogoniland (ORN1 to ORN10), and Twon Brass (TBN01 to TBN03) (see Table 5.5). However, eight indigenous respondents working as oil industry professionals preferred to be interviewed as local community respondents in Ibeno. The reason for choosing to participate in the survey interview as social actors, even though they met their criteria for expert witness where no confirmed. Nevertheless, recruitment of the sample populations was both under the researcher's designing the criteria and under the control of the respondents who make the decision to participate.

5.4.6.2 Conducting Survey Interview

Generally, all the interviews took the form of informal conversation, but engaging about their contextual experiences and perspectives, questions were open-ended, followed by more direct questions to obtain evidence from an earlier question. All interview sessions were audio-recorded using two smartphones (iPhone Operating System (IOS) and Android) concurrently to prevent the disruption of survey respondents and the researcher's thought process and coherency of information flow. A notepad for jotting observations and the participant research information sheet (see Appendix 4) were read out to obtain verbal informed consent (see Appendix 5). While using the oral interview schedule, the researcher's probing and prompting gave room for greater depth of response. The first interview phase was concluded once data saturation was suspected. All interviews sessions were conducted in English language with some infusion of some local jargon, lasted between 30 and 80 minutes. To prevent deviating from the research focus, avoid irrelevant information, and provide survey interview respondents with enough freedom to express themselves within the targeted timeframe, the interviews were guided by pre-planned related questions (Braun & Clarke, 2013). However, depending on the respondent's evidence, some unique questions

asked the respondents to clarify the information provided and the source of their perception and gain insights into the research phenomenon. At the end of every interview session, respondents were asked if the wanted a playback of the audio recording. The response to the answer was normally no. This approach for conducting interview ensured that the survey exercise was purposeful in generating representative evidence about the research problem.

Fortunately, some employees working in the oil and gas industry provided informed knowledge alongside their perception of community issues and the nature of oil mining to limit the possibility of one-sided subjective evidence. However, it was discovered these category of survey respondents was more knowledgeable of the impact of social-ecological system interaction around oilfields on sustenance and livelihood sources in the survey setting. Although subjective, the survey evidence gathered from a total of n=24 respondents that comprised local community respondents living around and embedded in oil mining fields and installations, were rich, deep and broad in the survey phase. This suggest that sample population selection technique through a systematised consideration of respondents purposefully achieved its objectives, by enabling collaboration and trust building between the researcher and survey respondents in the manner that make the respondents perceive themselves as co-creators of knowledge. Therefore, beyond perceiving the respondents as objects of study, the gathering of survey evidence for empirical analysis and knowledge generation confirm their usefulness beyond the survey exercise. Besides, aside from analysing this survey evidence qualitatively to generate research findings, knowledge from the survey phase will be applied to design of survey questions in the questionnaire design. Although, the evidence gathered may be subjective, the complementarity and corroboration of survey evidence from the three communities suggest that the phase of field survey was purposeful, and valuable for the research study.

5.4.6.3 Second Phase of Interview Process - Experts' Witness

The second level of interview sessions collated experts' perceptions from middle and senior cadre oil industry experts working in the survey setting. Survey respondents were recruited using the researcher's oil industry personal network and sourced from the LinkedIn website. The interview schedule had guided open-ended questions focussing on the research objectives to enable the survey respondents to express their perspectives freely (see Table 4). All survey interviews were conducted remotely using GSM telephones and WhatsApp. The interview sessions that lasted between 30 and 80 minutes were conducted until data saturation was suspected. This conversational style made the interview exercise interactive, situational, and active between the researcher and the respondents. Although n=10 survey respondents were targeted for the field survey exercise, at the end of the survey n=7 were successfully interviewed. However, n=6 evidence was admitted for data analysis because n=1 of the respondents only had administrative experience in an oil and gas project that did not eventually take off. However, he did confirm participating an oil pollution litigation in Ogoniland. Nevertheless, his practical working experience in the oil and gas industry was considered sufficient enough to meet the criteria of expert witness. A final total of n=6 survey interviews conducted with assigned a code for easy identification based on the sequence of interviews (OIE1–OIE6) were considered sufficient for transcription to complement survey evidence from the first phase of data collection. Apart from contributing specialised insight to the study, the expert witness provides hands-on valuable evidence that are representative extensive experience of interfacing with the social actors in the survey setting. More so, the evidence from the second phase of field survey complement, corroborate, and reinforce the first phase of survey evidence.

The segment of the interview phase also experienced its limitations from the inability to interview government agency employees for balanced perspective, despite several efforts and assurances. Experts from the public sector approached or recommended for survey interviews insisted on non-participation unless a lengthy official authorisation that required the signing of a non-disclosure agreement. Approached respondents under government employment cited personal security and possible victimisation as the reason for abstaining from the survey exercise. After a series of follow-ups, some considered participating in the anonymised survey questionnaire segment once the link was made available in the third segment of the field survey exercise. It was this type of difficulty in accessing survey respondents that influenced the researcher's adoption of snowball sampling to supplement the proposed purposive sampling, in the resolve to reach the hard-to-convince public sector respondents within the field survey timeline. However, to control the inability of reaching public sector respondents for survey interview, the study relied on the survey evidence from expert witnesses, whose job function required consistent interface with the regulatory agencies for incident assessment and oil pollution clean-up field visits. Across the two survey segments, survey respondents seemed satisfied that their identity would be anonymised, and many felt fulfilled contributing their quota to scientific knowledge generation.

5.4.6.4 Navigating Communication Difficulties Encountered During Field Survey Exercise

Despite the success of the first survey segment, the field exercise experienced some limitations. For example, the survey plans considered communicating the questions across all survey settings using the English language. However, there were instances where the respondent's knowledge of the English language was not fluent. Thus, an immediate switch of the language of communication to the locally popular "pidgin" English. Pidgin English is a Creole language that blends the English language, some words in Portuguese, and the local

dialects in local communities. Language may have generated some limitations to conducting this fieldwork, but researcher knowledge of the terrain enabled the surmounting of language barrier. Also, the interview process experienced GSM network connectivity issues or survey respondents who scheduled interview sessions after work hours, but often returned home tired. Although the interviews were held as scheduled by the respondents, it meant that the researcher needed to be more patient and attentive to the responses. Additionally, three survey respondents from Ibeno, Ogoniland, and Brass Kingdom, respectively, mostly avoid questions on the effectiveness of government system enforcement and capability. However, in line with the survey information sheet, respondents were allowed to skip any questions or express themselves freely without constraints. Likewise, technical terms and abbreviations were avoided, and when the survey respondents used either technical terms or abbreviations, clarification was sought for better understanding. For example, one respondent said, “We consulted with the DPO." DPO is a popular abbreviation in Nigeria that means Divisional Police Officer. Also, words such as “local environmental resources” were used to replace natural resource endowment in the literature review resources; all words with SESs were deliberately avoided throughout the interview sessions. By reflecting on survey interview evidence, the survey exercise generated empirically valuable evidence with richness for analysis.

For the broadness of evidence, survey interview provide knowledge that cuts across different level and scales of social actor’s interactions with the natural ecological system in the survey setting. For example, a retired security personnel from one of the oil multinationals (IAN05) provided an elaboration description of the network of oil installations of an oil multinational where he retired, their operational capacity and activities, the influence on the national economy and the social-ecological system. Other passionate respondents dispassionately provided evidence of their individual interaction with the ecological system

and invited the researcher to visit their locations to confirm the objectivity of their survey evidence. However, the generality of the local actors' evidence focussed mostly on the natural resource system/units' contribution to their sustenance and livelihood sources and the consequences of oil mining. Likewise, evidence on the interactions at different levels (with resource systems or other social actors) was often punctuated with individual case studies. For example, because some survey respondents are repositories of community history and traditional knowledge about natural resource system conditions before the advent of oil mining, they provided elaborate historical perspectives of context and the adventure of oil installations. These retrospective real-life experiences from interacting with different components of the SES provided more than deeper knowledge for data analysis. However, there were few respondents who were willing to talk endlessly about a particular point, which tended to make some interview sessions laborious and response outside the research scope. Nevertheless, the mostly efficient nature of the telephone in the location of the researcher (Lagos) and the survey settings (Niger Delta) contributed to the clarity of the field survey exercise.

5.4.6.5 The Researcher's Reflexivity

The survey interview involved a process of social engagement to interrogate understand the interaction within the social-ecological system based on how the convergence governance system (property rights) defined by historical structures of attachment, power, and privilege regulate social behaviours. The survey evidence from this exercise identified the impact of the natural resource system extraction on household income and communities' economic conduction based on how the contextual realities determine the social freedom of self-expression of occupation, entrepreneurial and social-cultural pursuit. For example, the reported depth of abnormality with the social-ecological system interaction during oil mining,

suggested the regulatory official indifference or helplessness toward holding some social actors to account for their operational rule infractions and the insecurity challenge. Also, the disturbing scene and abnormal behaviours painted by the survey respondents necessitated the researcher to consciously and unconsciously seek further clarification about some of the evidence. Despite the concern for subjectivity, all survey interview evidence complemented and corroborated each other.

Preliminary survey interview evidence on the contribution of natural resource system to sustenance and livelihood reveals that self-employment farmers, fishermen and women, farm produces and fishery products harvests processors and traders occupied a major share of occupation, income and wealth from the natural resource system. Besides, this category of social actors irrespective of age, gender, and occupation are impacted by the consequence of oil mining activities. However, the impact appears more severe for social actors grossly dependent on the natural resource system, without other secondary sources of income. While emotional from survey interviews are difficult to put into words or interpret, local social-actors anticipation and aspirations for a productive natural resource system through effective social-ecological system stewardship were common across the survey evidence. Nevertheless, all the local community respondents felt helpless to meet their household income needs without every member of the family putting up extra efforts. Although there are differences of scales of impact depending on the intensity of natural resource mining events. So far, identified challenge of regulating industrial scale of natural resource system and its effects on other social-economic system appear to expose non-oil natural resource dependent social actors to vulnerability.

It is this kind of the changing evidence assessment that underlines the fact that local community's economic potentials are often vulnerable and marginalised out of governance

system neglect. Yet, a significant challenge for establishing the realities from the respondents' perspective is the struggle of tracing and documenting these unforgettable experiences through qualitative data analysis. Much more, the analytical objective of qualifying these insightful experiences for determining the research outcome become another burden on the researcher's empirical judgement and competence in an empirical ecosystem with dichotomous stance on subjectivity and objectivity research result, that is sometimes at the expense of the depth and richness social respondents' perspective. Yet, such scientific scepticisms are likely to miss the evidence of who respondent are, their contextual experiences from interacting with the ecological system, the impact of the natural resource extraction on natural biodiversity which could be value for case-based reasoning for natural sciences scientific study. Thus, missing the aim of study the research problems that converges the social, ecological and economic dimensions of natural-resource-dependent contexts.

To avoid the dependence of a narrow perception for survey evidence, the researcher stocked to the selection criteria for interview respondents for diverse perspectives even after adopting the snowball sampling technique to navigate the challenges of accessing respondents remotely. Besides, as a remote field survey technique where the researcher as the subject of the research was not present in the survey context, the researcher unable to make personal observation of the social-ecological system condition. Thus, the sole dependence on respondent's experiences based on their attributed values. Nevertheless, the concern for subjectivity of field survey evidence meant that the researcher needed to serve as a knowledge filter by ensuring that the interview exercises were not concluded until the multiple perspectives that generated a diversity of evidence reached saturation point. Also, clarifications were made by comparing survey evidence with findings from a recent empirically structured study commissioned by the Bayelsa State Government (Sentamu et al,

2023), a subnational institution governing one Twon Brass Kingdom, one of the survey contexts. Additionally, evidence from the first phases of the field survey exercise was controlled by the field survey exercise interviewing the expertise witnesses. Furthermore, the determination to report interview evidence verbatim so that the voice of the respondent will be amplified for interpreting data analysis results is suggest to improve the trustworthiness of result.

While, the survey evidence from expert's witness corroborated the preliminary evidence from the local community sample population, there is another third phase of field survey that proposed to randomly collect data using survey questionnaire from a broader sample population. This systematisation of data collection suggest that varied perceptions of rich, deep, and representative evidence will be applied for data analysis. Notwithstanding, the field survey systematisation of efforts made to control the identified areas of subjectivity to prevent the respondent's personal opinions and grievances with regulatory authorities, Braun & Clarke (2013, p. 178) argued that something unique about qualitative methods is that it "does not prescribe methods for data collection." Yet, the qualitative segment of the field survey seems to have systematically collected some unique hardly explored evidence about the research problem around the survey context, which will coded and presented verbatims during the data analysis chapter (see Appendices 11). Also, the researcher field judgements and decisions transparency as a knowledge facilitator guiding the evidence gathering exercise up to the admission for analysis and interpretation suggesting a structure that is dependable. However, to strengthen the trustworthiness of result, the final thesis findings and conclusion that is supported by the data analysis of fields survey exercise were also exposed to stricter supervisory scrutiny before admission for thesis submission.

5.4.7 Third Phase of Data Collection - Quantitative Data Collection

5.4.7.1 Introduction

The research survey design collects and analyses human perceptions of respondents based on their accounts of real-life experiences with natural ecological systems in the survey setting. The third phase of the field survey includes the human population residing in both the rural and urban settlements across the described survey setting (see Figures 5 to 6). For example, it is normal to find oil facilities and installations in built-up urban environments around the Niger-Delta region. The field survey exercise randomly selected survey interview respondents from identified stakeholders during the mapping phase. Once the proposed respondents were identified, the study proceeded to map how they could be remotely located for online questionnaire participation. Respondents without preference for gender, above 18 years old, and resident in pre-identified urban and rural areas known to host oil mining or oil operation administrative offices were targeted to ensure diversity and a broader response to the survey questionnaire. The online survey link was randomly posted on major social media for public participation. This approach was to limit the researcher's subjectivity and to guarantee wider coverage of the sample and male/female representation of the larger populations.

5.4.7.2 Probability Sampling

To achieve a statistically sufficient sample size in response to Objective 5, different literature was consulted for guidance and empirical insights. For example, although Cochran (1977) established the sample size formula based on margin of error, Cohen (2016) developed a formula based on statistical power and effect size. Also, Morrison (1993) underscored that the random sampling size and statistical test type can be determined either by ensuring that the sample represents the features of the wider population or by using a table that, from a

mathematical formula, indicates the appropriate sample size for a given number of the larger population. Thus, after considering the type of survey instrument, educational level, infrastructural availability, technology penetration, demography, and the rural nature of the survey context, this study adopted the Krejcie and Morgan's (1970) formula (see below) based on ease for calculating and justifying statistically significant sample size estimation for a categorical type of data at a 95% confidence level with 5% error.

From Krejcie & Morgan (1970) formula

$$\mathbf{S = X^2\ NP\ (1\text{-}P) / d^2\ (N\text{-}1) + X^2P\ (1\text{-}P)}$$

Where;

S: needs sample size,

$\mathbf{X^2}$: the chi-square table value for one-degree freedom at the desired level of confidence (1.96)

N: population size (28,800,000 people) (NBS, 2024)

P: the proportion of the population (assumed to be 0.50 since this would provide the maximum sample size), and

D: the accuracy degree expressed as a proportion (0.05).

ion (0.05)-error the researcher wants to accept.

Applying the above formula for this survey sample size

$$\Rightarrow \quad \frac{1.96^2 \times 28{,}800{,}000 \times 0.5(1-0.5)}{0.025 \times (28{,}800{,}000-1) + 1.96^2 \times 0.5(1-0.5)}$$

$$= > \quad \frac{3.841 \times 28{,}800{,}000 \times 0.25}{(0.0025 \times 28{,}799{,}999) + (3.841 \times 0.0025)}$$

$$= > \quad \frac{27{,}655{,}190}{75{,}000.96}$$

= > 384.09. S = 384

This preference compensates for the likelihood of a response rate lower than 100%. Thus, a sample size of 384 was calculated using the formula as against the targeted sample size 387. This sample size is considered statistically significant to capture representative evidence for generalisability of results from the specific study sample to larger populations across specific contexts (Lesko et al, 2018). Moreover, the combination of purposive, snowball, and probability sampling means that the field survey exercise was able to collect exhaustive and contextualised evidence that generate external valid credible data analysis result and findings.

5.4.7.3 Controlling Sampling Subjectivity in Survey Questionnaire Distribution

Irrespective of field data collection rigour and sampling subjectivity in a particular survey setting, the online survey technique is likely to exclude respondents without telephones or internet access during survey questionnaire distribution. To minimise this potential sampling bias, internet data were provided with 100 megabytes to enable as many individuals with smartphones to participate in the survey exercise. Finally, the probability sampling technique provided participants from all genders and social demography from a minimum of 18 years with equal opportunity of selection in the survey. However, based on the risk assessment conducted independently by the university-affiliated global risk manager during the ethics compliance approval, remote data collection was also useful and feasible for reaching the sampled population in the survey setting. Nevertheless, the online method introduced its own unique empirical challenges of internet service access to internet technology by survey respondents in different rural and urban locations, terms of use, and possible internet downtime (Salmons, 2017). Yet, the online field survey exercise provided an opportunity for partially educated respondents (primary school leavers) to highly educated (PhD degree holders) respondents across the survey setting to participate in the survey

exercise. Therefore, the blending of non-probabilistic and probabilistic sampling ensured that evidence from the different sample populations complemented each other and provided perspective that covers all the dimensions of the phenomenon under study.

5.4.7.4 Survey Questionnaire Development

The thematic analysis of qualitative evidence provided insight to guide the survey questionnaire design (see Appendices 1). Nevertheless, the survey interview questions were compared to the identified indicators in SESF to confirm that the outcome of qualitative data analysis corresponds with the theoretical framework variables (see Table 3 and 4). The final version consists of 22 questions used to approach respondents and collect evidence. The rigour in designing and communicating survey questions in concise and understandable English language ensured the respondents did not misinterpret any questions. Nevertheless, survey responses provided answers to options of 'I do not know, "Not Sure," and "No Answer" so that survey respondents are not compelled to answer any questions they do not know (see Appendix 2). Besides, the survey answers options were infrequently distributed to ensure that each respondent's carefully read and understood each question before providing an answer. Additionally, in order to confirm that respondents had practical experience of SES and the research problem, respondents were required to confirm that they had visited SES around the oil mining context by selecting available options in the questionnaire. Furthermore, respondents were required to confirm that they were over 18 years old in line with ethics compliance before their evidence was considered valid. To ensure that the survey questionnaire was feasible for evidence gathering, the survey design compared the questionnaire design criteria with Gehlbach and Artinio's (2018) survey questionnaire checklist.

5.4.7.5 Questionnaire Distribution

At the time of designing the research strategy there was a physicality restriction because of COVID-19. Remote questionnaire distribution was the only available choice based on risk assessment. Once the survey questionnaire was designed, it was uploaded into the University JISC online survey platform with a lower limit of n=387 respondents for random participation in the survey across the selected survey setting, (see section 5.4.7.2 on probability sampling). The selected survey settings were Akwa Ibom, Bayelsa, Cross River, Delta, Edo, Rivers, and the commercial capital, Lagos States and Abuja. Once the survey questions were inputted into the online questionnaire platform, it was activated to collect evidence on August 3, 2023. The questionnaire link was shared widely and randomly via social media platforms and direct emails and short messages via GSM and WhatsApp. Although, online survey questionnaire platform experienced a 24-hour glitch on October 15, 2023 because of a technological glitch (see Appendices 7 and 8). However, the JISC online survey platform allowed respondents to complete questions remotely and organised field evidence for data analysis. Aside from applying the diagnostic framework design to collect, representative and exhaustive evidence from multiple perspectives, the online questionnaire provided an opportunity to concurrently reach a larger sample size within the proposed survey timeline. Also, the remote survey meant that the questionnaire was administered online and allowed the field survey exercise to engage with respondents across multiple locations over a long period of time concurrently.

Figure 6: Sequence of Field Survey Exercises and Timelines



5.4.8 Secondary Data Sources

The field survey evidence was supplemented with secondary datasets for the purpose of confirming the objectivity of primary data. This evidence will be sourced from available government sources or multilateral agencies' think-tank research documents and news media publications to clarify corresponding research questions (see Figure 6). Most importantly, the data collection instruments generate representative evidence to concretise validity (Creswell et al., 2003).

5.5 Data Processing and Analysis

The data preparation, code dictionary design, field evidence coding, sequential process of data analysis, generating findings, and interpretation provide a systematised guideline to achieve the research aim and Objectives 5, 6, 7 and 8. Specifically, the entire data analysis process explaining the field survey evidence relationship and the richness, depth, and broadness of thematic and statistical analysis is to confirm the broadness and accuracy of the SES in exploring complex problematic situation. The data analysis approach sequentially applied qualitative analysis to generate meaningful segmented results and findings that provided the opportunity to evaluate the dependability and trustfulness survey evidence from the first phase of data collection. Where necessary, revision of questions was made in the quantitative survey to complement the qualitative findings. Also, it provided the

opportunity to corroborate, confirm, or even refute the findings. This data analysis approach analyses the perception of the accessibility and vulnerability to natural resource system value for sustenance and livelihoods in the social-ecological system in the survey setting as the key measuring indicators to determine social-economic outcomes at the household, community, and national levels. Accessibility represents the ability of the social actors grossly dependent on the social-ecological system to extract the natural resource system values according to their property rights. Also, the analysis considered the effectiveness of governance system capability and enforcement based on the social perspective of the ecological system condition impact on harvest of natural resource units. Thus, the effectiveness level of the governance system enforcement represents an important outcome interconnecting the natural resource system with the social-economic outcome in this SES analysis.

5.5.1 Qualitative Data Analysis Segment

5.5.1.1 Introduction

To systematise the qualitative data analysis, the mapped SESF variables were coded in a dictionary to guide the categorisation survey evidence (McGinnis and Ostrom, 2014), but with specific emphasis on the outcome variables that integrate people, natural resource systems, sources of sustenance and livelihood, and social-economic outcomes (see Appendices 11). Then, the researcher manually transcribed the audio recordings for familiarity and accuracy of the survey evidence. This implies that after recording and transcribing interview evidence, the survey evidence was coded and categorised using the code dictionary as a guideline to generate themes that provide insight for designing the survey questionnaire. Besides, secondary social and economic datasets serving as proxy indicators were applied to control the possible subjectivity associated with first and second layer of field survey evidence data (De Voc et al., 2019). Nevertheless, thematic analysis of

the field survey exercise relied heavily on the researcher's empirical experience and judgement that was based on the data analysis results from coding exercise alignment with code dictionary and SESF variable (Bryman, 2008). Thematic analysis is a method for identifying, analysing, and reporting patterns to reflect reality and unravel the surface of 'reality' (themes) within data (see Appendices 11). The thematic analysis examined the intersection between the social actors' realities based on practical experiences, the natural resource system, and the social-economic outcome. The value attributed to the natural resource units, access, and vulnerability to sustenance and livelihoods determined the interpretation of the outcome effects in the survey setting.

5.5.2.2 Familiarisation with Survey Evidence and Transcription of Audio Recordings

The researcher personally conducted the interviews and repetitively listened to the interviews, transcribing the audio recordings and field evidence manually. Although the exercise was very cumbersome, the data analysis process commenced by designing a code dictionary (see Appendix 3). Moreover, the process of transcription of interview audio recordings commenced familiarisation with the field survey data (Riessman, 2008); once the audio evidence was transcribed, the evidence was ready for thematic analysis. The audio recordings were transcribed verbatim and non-verbal utterances such as "yawning" and "laughter" to show tiredness and abrupt raising of voice tone to emphasise point to show "anger'. Once the audio evidence was transcribed, the evidence was ready for thematic analysis.

5.5.2.4 Unit of Analysis

The unit of analysis applied in the qualitative data analysis was important to understand the reality of the research problem, its manifestation, and how survey evidence explains it. Moreover, the research problem cannot exist independently from the experience

and perception of its human population in the SES under study. According to Easterby-Smith et al. (2012), the unit of analysis is the entity that forms the basis of analysis of the study result. This implies that the unit of analysis, as words, sentences, phrases, and paragraphs transcribed from the survey respondents from audio recordings from the field survey, becomes meaningful evidence for generating results and findings.

Figure 7: Interaction of SESF for Field Survey Exercise, Data Collection and Analysis Techniques

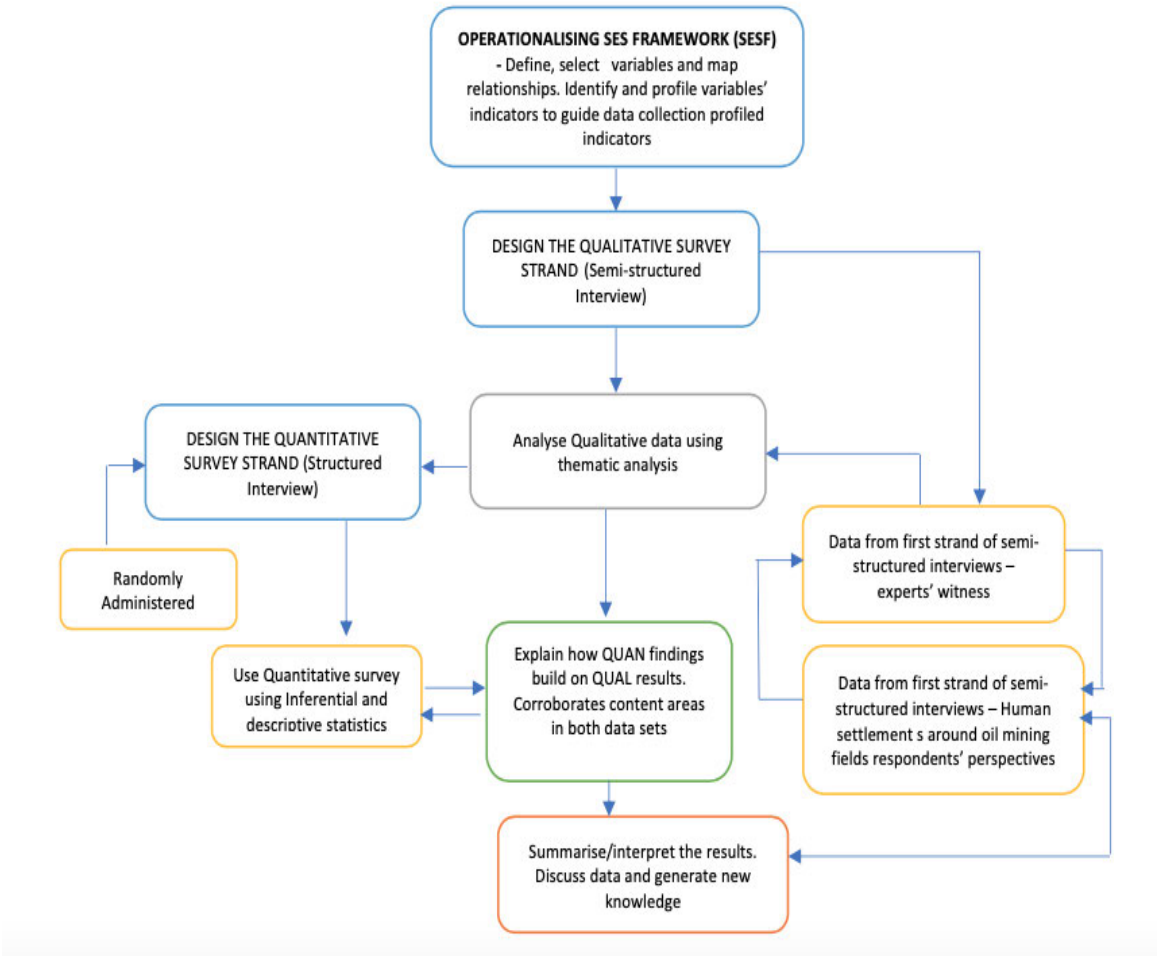


Table 6:Alignment of Research Questions, Objectives and Data Analysis Techniques

Research Objectives	Method of Analysis			
	Theoretical Analysis	Thematic Analysis (Braun and Ckarke, 2006; Braun et al, 2019; Corbin and Strauss 2008 and Leslie et al 2015)	Descriptive Statistics (Onwuegbuzie and Combs 2011)	Inferential Statistics (Onwuegbuzie and Combs 2011; Nagel and Krejcie and Morgan's, 1970)
1. To understand the relationships between oil mining activities and other natural resource system values around the oilfields for explaining Nigeria's social-economic problem.	X	X	X	X
2. To explore the historical and social-political foundations that have shaped the evolution and structure of natural resource management institutions in Nigeria.	X			
3. To explore how the effectiveness of natural resource management institutions linkages to social-economic outcome can be evaluated from the perspective of the social-ecological systems around oilfields.	X			
4. To conceptualise and design a context-specific theoretical framework for investigating institution capability and enforcement on natural resource system values and its impact on social-economic systems in the social-ecological system around oilfields.	X			
5. Building on research objectives 2, 3 and 4, to design and apply a purposive mixed-methods diagnostic framework for collecting three layers of field survey evidence to connects the research problem with research findings.	X			

6. To reinforce the achievement of objective 5, qualitatively analyse the evidence gathered from survey interviews to interpret the outcomes and generate insight for designing the survey questionnaire.	X	X	X	
7. Conduct a quantitative analysis of survey questionnaire evidence to generate results and findings for meeting Objective 6, as a preliminary understanding of the research problem.	X		X	X
8. To complete Objective 5, integrate and compare the data analysis results and findings from both phases of data analysis to comprehensively explicate relationships between the natural resource management and the social-economic problem.	X		X	

5.5.3 Quantitative Data Analysis Segment

Once the data and result generated from the qualitative segment captured evidence of the selected indicators for the mapped 7 first-tier variables and the second-tier variables, the quantitative data analysis exercise commenced (see Appendices 3). To check for a fit to statistical assumptions, the questionnaire evidence was reviewed. Descriptive data analyses were illustrated using tables for easy understanding of the result. Then, Pearson Chi-square and Spearman Correlation tests were applied to determine the relationship between categorical variables and statistical significance (see Chapter 7). All statistical tests and calculations were performed using SPSS 29. Thus, the results should be understood as a synthesis of knowledge from mixed-methods to complement, corroborate, and confirm the qualitative data instead of a comparative analysis of another type of data.

5.5.4 Field Data Interpretation and Presentation

After completing the different data analysis exercises, the research results are presented in two different chapters using analysis of SESF mapped variable (see Table 5) to bring together how the different results complement, corroborate, or refute each other. The first data analysis chapter provides a guideline on how the field survey evidence from the two semi-structured interviews were analysed to generate the qualitative aspect of the research findings. The second data analysis chapter illustrates with a table and statistical presentation, how the evidence from the survey questionnaire connects to the quantitative research findings. Then, the result from the quantitative data analysis is applied to complement and corroborate the qualitative results and findings using pattern-matching for a holistic explanation of the research findings and how they interrelate. The analysis provides a summary of the interpretation in the discussion chapter to connect the study findings to existing theories from previous studies. The data analysis result and research findings were

processed through the lens of Lincoln and Guba's (1985) four criteria of credibility, transferability, dependability, and conformability. Although the research findings might be argued to be subjective because of the qualitative mixed-method approach for the study. However, Costanza et al. (2007, p. 268) submit that the "objective measures using the proxy dataset to capture social-economic outcome are mostly analysed using the researcher's subjective judgement, hence the distinction between objective and subjective indicators is somewhat illusory." Nevertheless, aside from the scepticism of research findings subjectivity, the researcher's reflexivity, the rigour, systematisation, and transparency illustrated in this research process suggest that mixed-methods that blends the objectivity associated with the quantitative techniques to generate scientific balanced and externally valid research findings to similar natural resource-dependent contexts.

5.5.5 Research Findings, Interpretation and Inference Validity

For emphasis, constraints associated with the field data collection exercise are vital information to spotlight the conditions under which the data were collected, especially given the contextual dynamics that guided research findings. Firstly, to illustrate the validity of this mixed-methods study that captures the multiple human perspectives of the social-ecological system under study; the research result and findings reflects representativeness, genuineness, depth, richness, and broadness of survey respondents' perceptions. Secondly, in the quantitative segment, credibility was controlled through systematic sampling, applied descriptive and inferential statistics for data analysis to generate results and findings that is retraceable to the qualitative results and findings. Therefore, one empirical value of this mixed-methods study is the dependability the data analysis result that achieves internal and external valid expectations because of the rigour, dependability and transferability of the field

survey and data analysis tools application approach that complement and corroborate each other.

5.6 Limitation

The adoption and application of each research method contains its limitations. For example, the survey evidence from semi-structured interview represents subjective perceptions of the survey respondent. Also, the survey and interview sampled populations were biased towards respondents in the six south-south regional states in Niger Delta, even though there five other oil-bearing states in Nigeria. Nonetheless, the mixed-methods approach applied for field survey exercise was not biased against demography, gender, culture or ethnicity; everyone was provided equal opportunities of participation as long as they resided in the communities for survey interviews or urban cities for survey questionnaires, including Lagos and Abuja that were non-Niger delta states. Also, the adoption of snowball sampling midway through the field survey exercise may suggest a natural bias because of the inability to interview the hard-to-reach sampled population considering the risk assessment advice. However, the adoption of snowball sampling was necessitated by the abstinence from survey exercise, citing personal safety over the sensitivity of the consequences of oil mining in the context and the hard-to-reach sample population. Additionally, there was the challenge of how the sampling strategy achieved representative respondents in a survey setting where epileptic power supply was among the core failings of basic infrastructure. This may suggest survey bias against varied sample population without access electricity power to charge smartphones during remote survey for data collection. However, the questionnaire was allowed for 72 days to provide ample opportunity for equal participation (see Figure 7). Therefore, this mixed-methods approach to the field survey exercise covering a diversity of sample populations allows this study to

collect multiple perspective that identified patterns and perspectives for explaining the research problem.

5.6.1 Fieldwork and Ethical challenges

Before embarking on the fieldwork, the research ethics compliance approval was obtained from the ethics committee of the School of Natural and Social Sciences and the University of Gloucestershire (see Appendices 6). This important milestone provided guidelines for ethical defensible data collection practices to the researcher. Field survey exercise recommended the need for sensitivity to the researcher and survey respondents' personal safety, especially when respondents perceived any question was sensitive; the researcher never attempted to prod further. As the research involved interviews, there were a few ethical concerns about the research that needed to be addressed during the interview segment. These include:

- The issue of confidentiality and anonymity: Some respondents were reluctant to answer some survey questions (specifically questions related to governance system effectiveness level) despite assurances that the survey respondent's identity would be anonymised. This suggest freedom of expression challenge and people vulnerability to operational rule enforcers bias in the survey setting.
- Survey respondents' suspicions of the survey exercise as government institutions spy on social perception of oil mining consequences or a precursor to commencing a developmental project lacking in communities. This suggests the need to provide verifiable institutional linkages where respondents can cross-check the creditability of survey exercise.
- There was a slight risk of respondents becoming emotional and in some instances expression of helplessness when responding to oil mining consequences on the social-

ecological systems. In such occasion, respondents were asked whether to continue with interview for the purpose of the coherence in provide feedback.

- The inability of achieving gender balance in the gathering of survey evidence despite the attempts. Future studies can consider an empirical approach to achieving gender balance in the evidence during survey exercise.
- There was the concern of people wanting incentivisation for participating in the survey exercise. The researcher considered incentivising survey respondent to participate in the survey interview would suggest the subjectivities of survey evidence. Thus, never acceded to any request for incentivisation during field survey at any point.

Identifying and initiating attempts to minimise the limitations of each research activity in this chapter provided the researcher field survey exercise reflexivity. Nevertheless, to minimise a potential selection bias, once survey respondents were identified during the initial stakeholder engagement, interviews were conducted at the respondent's convenience, and in some instances, the community mobiliser's telephone was used for the survey interview. As this chapter has highlighted, a code dictionary design guide by SESF (McGinnis and Ostrom, 2014) was to control some form of subjectivity for the qualitative data analysis segment. During the field survey, the credibility of respondents to ensure the representativeness of evidence was an important aspect of the field survey exercise. Moreover, the pragmatist paradigm guided the mixed-methods approach for the field survey, which was designed to capture multiple perspectives to prevent bias towards certain perspectives. Nevertheless, this study does suggest that limitations and subjectivity can be eliminated from the research process. Rather, attempts were made to control the subjectivity as a constructive element of the field survey exercise using the mixed-methods approach for opinions.

5.7 Chapter Summary

This chapter provides the background of the research strategy, from the process of conceptualising the study, method design, data collection, analysis of evidence, and interpretation. The analysis of the survey evidence to generate results, and findings from the thematic, Pearson Chi-Square, and Spearman Correlation analysis means that the mixed-methods approach provides a comprehensive understanding of the research problem. Although, this context-specific exploration of social perception to evaluate social-ecological system interaction may not predict the social, ecological, governance and economic outcome effects on other systems. However, applying the designed sequential mixed-methods, data gathering and analysis approach that present data analysis results in two separate chapters suggests that this research strategy provides complementary, corroborations and triangulation strength and rigour that future study seeking to reinforce the validity and trustworthiness of result can consider. This implies that a Pragmatist Instrumentalist epistemology innovating a mixed-methods diagnostic framework to study social-ecological system problems provide an ethical defensible and empirical dependable guideline that future studies can consider. Besides, the rigour, systematisation, and transparency of this social-ecological system perspective study suggest that traditional philosophies scepticism of Pragmatism may be due to the unfamiliarity with the depth, scale, and breadth of Pragmatist mixed-methods studies. Likewise, this Pragmatist's mixed-methods study purposively developed a diagnostic framework generated ethically defensible and representative evidence of the social realities within the social-ecological systems around oilfields, countering Popper's (2005) argument that the Pragmatists' focus on practicality over truth can be misleading.

Chapter 6

Results and Analysis of The Qualitative Data

6.1 Introduction

This chapter provides background on the qualitative data analysis approach for generating the results. From the operationalisation of McGinnis and Ostrom's (2014) social-ecological system framework (SESF) in Chapter 4, to guide a mixed-methods diagnostic framework research strategy in Chapter 5, this chapter reinforce the achievement of Objective 5, by qualitatively analysing the survey interview evidence to interpret social-economic outcomes and generate insight for designing the survey questionnaire (Objective 6). The thematic analysis, code the evidence, categorises and reports emergent patterns (themes) result according to the SESF, using tables and visual illustrations. Verbatim quotes from survey interview are highlighted to amplify the respondent voices, clarify the trustworthiness of result and reinforce research findings. Then secondary evidence is applied to corroborate data analysis results. This qualitative result chapter beyond revealing a context-specific social, ecological, governance system and economic interactive impact on household income, micro-community economic condition and the national social-economic outcome, the deep and broad knowledge of oil mining effect on social-ecological systems provide background knowledge that natural scientists can test further.

6.1.2 Thematic Analysis

The qualitative data analysis starts with the familiarization with the survey evidence through iterative listening to the audio recordings before manual transcription, code dictionary design, appraising the codes to ensure evidence are appropriately categorised and the coding process until the researcher perceive a level of satisfaction is attained (Braun and

Clarke, 2006). In line with the study epistemology, this thematic analysis mainly interprets findings from the multiple respondents' practical experience in response to the research questions (See Tables 7 and 8). Practical human experience in this study represents interview respondents who have had repetitive real-life relationships with the SES around the oil mining context, demonstrated an understanding of the situational context within which the evidence originated, and were respected for their knowledge as industry experts. The thematic analysis exercise involves exploring the dimensions of SESF variables to methodologically map relationships from field survey evidence and for discovering patterns.

6.1.3 Transcription

All interviews were audio recorded and manually transcribed by the researcher. Interviews conducted using pidgin English were translated into English land. The transcription process requires a time multiple of between 5 and 8 hours (Braun and Clarke, 2013). All interviews were transcribed verbatim in the English language to an average of 7 pages each. The data analysis sought to make sense of hundreds of pages of survey interview transcription from 30 respondents and connect field survey evidence to bring structure and meaning to the collection of survey evidence, data analysis results and research finding in line with Objective 6. Transcription was compared with field notes at the end to ensure the transcripts were tainted with personal bias. Although, some transcription process were quite straightforward others were more difficult because of the clarity of the recording which was dependent telecommunication or internet efficiency applied for the remote survey. For difficulty of transcribing the audio recording because of the respondent's communication style, the iterative process of clarifying the pronunciations of words, help resolved the challenge.

6.1.4 Examining, Comparing and Organising Codes to identify Existing and Discover New Themes

After re-reading the interview transcripts and comparing them with the literature, counterchecking, comparing, and corroborating the survey evidence with the theoretical framework, the coding process started. The process of reflecting on the research objectives, SES framework variables, data collection indicators and survey interview evidence means that the codes were continually reviewed and refined until it was considered fit for data analysis. The appropriateness of each code was dependent on whether it captured an important element of the research objective or represented meaning within the survey evidence (Braun and Clarke, 2006). To control subjectivity, the researcher adopted the McGinnis and Ostrom's, (2014) first-tier variables, considered and received insights from the code dictionary by Tribaldos et al. (2020), and Herzog et al. (2022) to design a code dictionary for data analysis (see Appendices 3). A code dictionary consists of a definitive list of codes with a label, a definition, and a source of identification (Braun et al., 2019). Also, to overcome possible interpretation errors, deductive coding was complemented with inductive coding, verbatim words, phrases, and sentences from interview respondents were coded to maintain the original survey evidence. Additional, extant literatures were reviewed to reconfirm the consistency of codes with the findings that emerged for the coding exercise (see Tables 9, 10, 11 and 12). The rigor of designing the code dictionary, assigning codes, sorting words, or sentences from the field survey evidence ensured the traceability of the emergent themes, results and findings to each survey interview evidence in the survey context. The thematic analysis was analysed using Nvivo 20 software.

6.1.5 Reviewing Themes by Appraising Codes Iteratively Reassign Code

For the dependability of data analysis process, the codes were categorised into seven variables: setting (S), resource system (RS), resource units (SA), social actors (SA), interactions (I), governance system (GS), and outcome (O) (McGinnis and Ostrom, 2014). Aside from reporting coding results according to SES variables, new codes not originally captured in the code dictionary were discovered (Appendices 3 and 11). The inductively identified codes from the coding exercise also generated emergent pattern. For example, codes on security concerns and emotional response to ecosystem disturbance generated new patterns. The field note was re-consulted to clarify expressions of emotions (by IAN04, IAN08, ORN07) that reflect anger, anxiety, and frustration from the survey interview evidence. After listened iteratively to the interview audio recording, expression such as 'joy', "laughter", "helplessness", or 'anger" were identified as emotions. Further clarifications were made to the Nvivo software to identify verbatim evidence to code 'emotional response to SES disturbance.' This was clarified from survey evidence on the payment of compensation to individuals in Ogoniland based on a competent Court verdict (ORN04). Further clarification was made to corroborate the evidence from publicly available report (Leigh Day, 2015). Besides, the scientific study evidence UNEP (2011), Francis et al. (2012) and Sentamu et al. (2023) were explored to corroborate evidence from in the survey setting. This knowledge facilitated the coding of a subtheme for identifying economic and non-economic opportunities in the survey setting. Moreover, the data analysis process ensured that the broad and varied perspectives from the two sampled populations in the survey interview survey were explored in-depth to prevent relying on only few respondents' perspectives.

The structured data analysis results process of reflecting, examining, comparing, organising, reappraising and confirming survey evidence linkage to code dictionary attributes

and coding activity outcome necessitated the inductive consideration of new codes. The conception and addition of new codes to second, third and fourth tiers data analysis process (in the governance system, operational rules had codes, and the interaction had 8 new codes), enhance the flexibility and extended the diagnostic capacity of the SES framework to examine the interactive patterns of natural resource extraction in the survey context. Using the 33 attributes (comprising of 7 first timer codes, 21 second tier codes, 12 third tier codes) in the code dictionary based on the diagnostic framework to code all 30 survey interview evidence through Nvivo software generated a total of 2051 codes (Appendices 11). Although the setting (S) that representing one of the SESF variables was described from extant literatures in Chapters 5 and 6, the coding exercise deductively and inductively generated a total of 36 codes (comprising of 7 first tier, 21 second tier, 11 second tier and 4 fourth). The rationale for the selection of third and fourth-tier variables to modify the foundational social-ecological theory (see Chapter 4) was reinforced by the completion of the coding exercise. By structuring and concretising the linkages between survey interview evidence, audio recording, transcripts, code dictionary, codes, results and findings through analytical process provide transparency to assess the credibility and dependability of this data analysis exercise. Although, the qualitative thematic analysis process may be reflective of the researcher's judgement, this results sand research findings speaks to specific outcome situations within the confines of the SES framework. Also, the evidence from questionnaire survey will be applied to complement this qualitative result for the purpose of controlling thematic analysis subjectivity.

6.1.4 Data Interpretation and Presentation

The coding analysis that involved managing large volume of interview transcripts through categorisation and description of the concurrent interactive outcomes in the survey

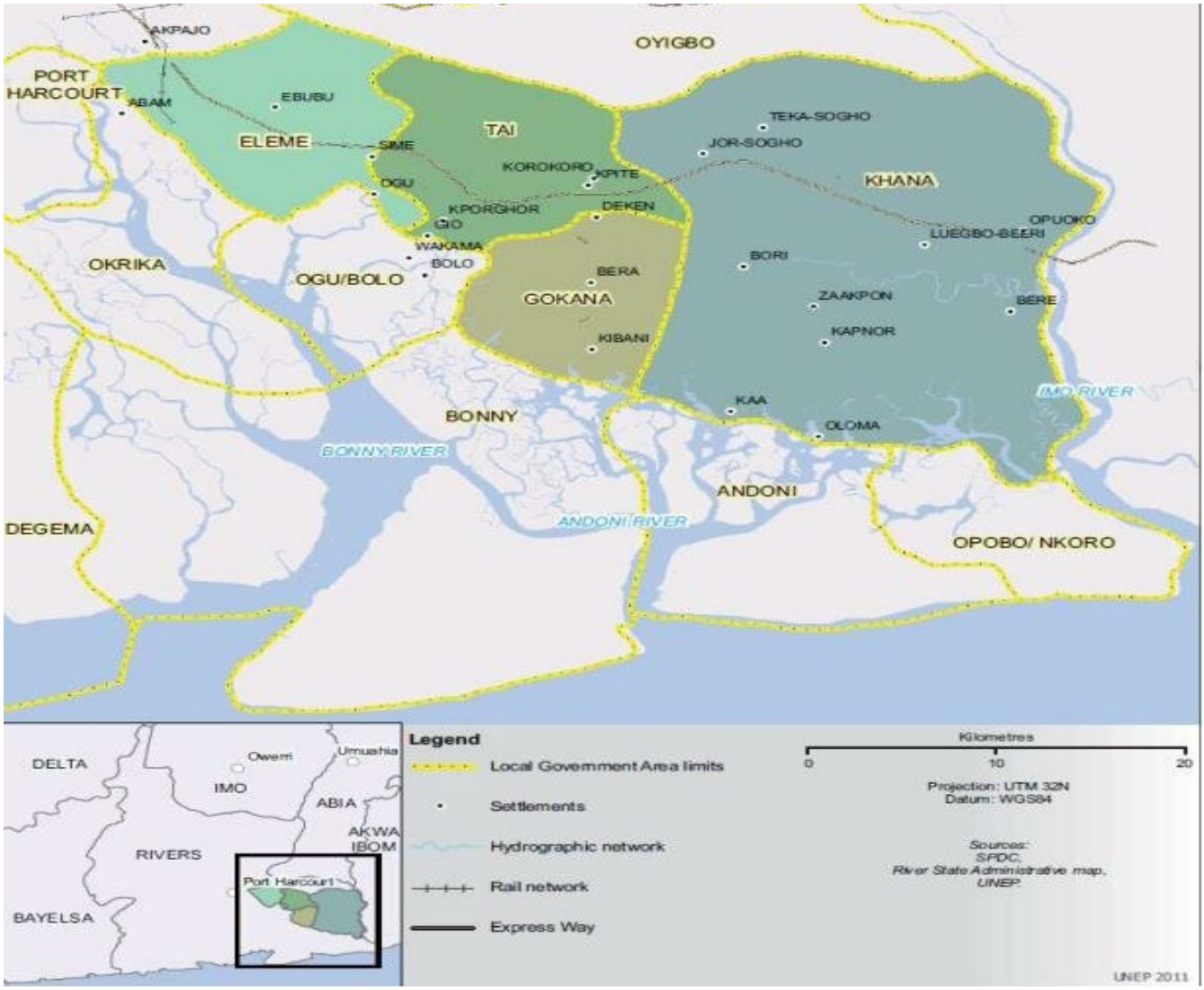
setting needed the interpretation and presentation to accentuate its trustworthiness. From the allowing the voice of the respondents speak for themselves by inserting the verbatim evidence to the emergent pattern, the researcher's knowledge mapped the relationship of the identified pattern from the data analysis exercise using the traditional 'analogue' mind mapping approach through Microsoft Word software for clarity, with an inscribed explanation beneath each figure. However, the outcome effects are theoretical explained from the thematic analysis results that emphasise the social-economic impact of the multiple of interactions between the both resident and of oil mining social actors was the ecological effect (1). The ecological effects represent the influence of natural resource extraction and transformation by the terrestrial, coastal and marine ecosystems and natural recreation facility conditions. The social effects (2) represent the influence of the natural resource systems extraction on the level of trust, cultural attachment, health implications, security condition in the social-ecological system. The governance system effect (3) represents the effectiveness level of the governance system on SES stewardship, management of the externalities impact and security concerns. The economic effects represent the combinative impact of the ecological, social and governance system effects on household income and, micro-community economic condition levels and its spill over on the national economic outcomes based on the ratio of dependent on the natural resource systems in the survey setting. For clarity, this data analysis generating the results assesses the social perception of primary survey evidence generated from the field survey exercise. Expectedly, the exhaustiveness and representativeness of the results and research findings will be assessed for the trustworthiness and dependability.

6.2 Setting (S) (Background and Description of Survey Setting)

6.2.1 Ogoniland

Ogoniland is made up of Eleme, Gokana, Khana and Tai local government areaa made up of several towns and villages, (an oil-bearing sub-nation state in the south-south region of Nigeria) all bridging the southern rainforest between Rivers and Akwa Ibom States through the mangrove forest bordering the coastal and marine ecosystems crisscrossing communities and island settlements (see Figure 8). The ecosystem around the coastline of Andoni and Bonny rivers provides opportunities fishing, farming and other natural recreational facilities. The geographical area is estimated as 1000 square kilometre with a population of 831,726 (UNEP, 2011). However, data analysis result reveal that the male population are predominant in the largescale fishing occupations and farming mostly for livelihoods. Then the females when not supporting their spouses, are mostly involved in small-scale fishing and seafood gathering from the shallow swamps and waters, farming, and processing harvested products for sustenance and trading. Additionally, the women explore the rainforest and mangrove forests for firewood, different species of vegetables and wild medicinal plants for the same purpose. The geography is popular for its hydrocarbon deposit and social-ecological system pollution, which unfortunate contribution to the cessation of oil mining activities since the mid-1990s (ORN02, ORN04). Despite the dormancy of oil mining activities in the geography, incidents of oil pollution are still experienced from seepages in abandoned major oil pipelines and vandalisms by desperate individuals stealing crude oil. The prolonged abandonment of the oil installations and untreated environmental contamination is reported to accentuate the fragility of the social-ecological system for social-economic activities. This SES condition contributed to the conflictual situation and frequent social agitations identified from survey evidence (ORN01-10).

Figure 8: Map of Ogoniland



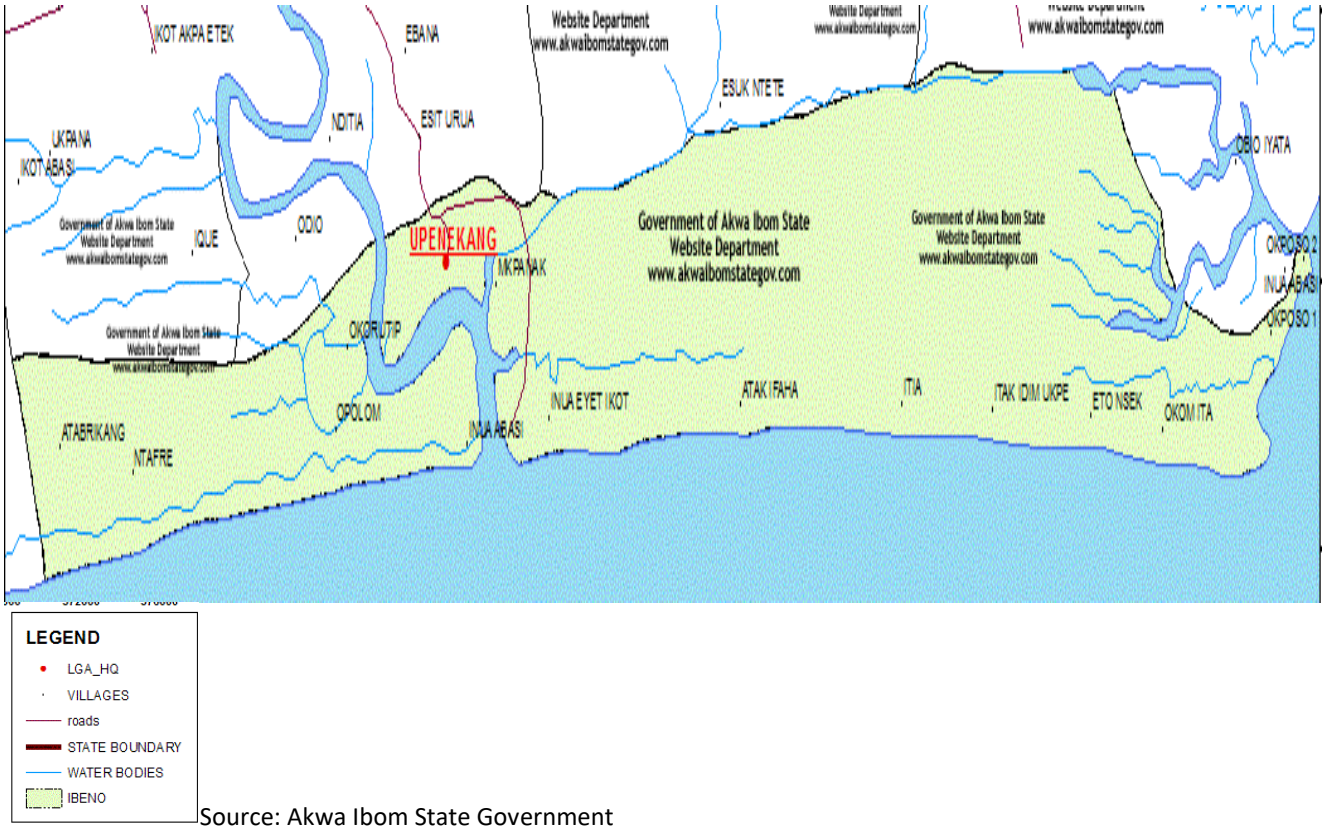
Source (UNEP, 2011)

6.2.1 Ibeno

Ibeno is a local government area made up of several towns and villages bordering coastal and marine ecosystem made up of shallow streams, tributaries, rivers (notably Qua Iboe River), and mangrove swamps all overlooking the Atlantic Ocean (see Figure 9). The beach stretches several kilometres along the coastline of Akwa Ibom State, a bordering River State to the west and Cross River State to the East. The ecosystem provides opportunities for largescale fishing and natural recreational facilities and tourism (ORN07, ORN09). The upland of the geography contains fertile soil for small-scale agriculture. The geographical area is

estimated as 288 square kilometres with a population of a population of 78,840 (NPC, 2006). Fishing is mostly a male-dominated occupation, while women engage in gathering seafood from the shallow swamps and waters, buying and processing the varieties of fish from ocean-going trawlers and other local fish folks for trading in different markets. The women are reported to travel 425 kilometres to Ogoja to procure food crops for resale in the local market to generate income because of the alluvial beach sand in the lowlands (ORN04, ORNO9) (see Table 7). Nevertheless, there are people are engaged in paid employment in different categories. The geography is popular for its hydrocarbon deposit hosting some of the largest collection of oil and gas installations in Nigeria (IAN04, IAN09).

Figure 9: Map of Ibeno



Source: Akwa Ibom State Government

6.2.1 Twon Brass Kingdom

Twon Brass Kingdom is an island, comprising several communities in Bayelsa State bordering River State to the west and Delta State to the east. It has limited land mass comprise

of rainforest, mangrove forest and swampland all supported by diverse coastal and marine ecosystems (see Figure 10). This ecosystem is are habited by biodiverse wild animal, fishery, aquatic lives and plant species and the forest is home to biodiverse species of economic trees such as timber, firewood, palm and other medicinal plants. The geographical area is estimated as 288 square kilometres with a population of a population of 184,271 with an estimated geographical area of 1,342 square kilometre (NPC, 2006). The land area aside from providing resources for the physical development of communities' housing and infrastructure needs, contains fertile soil for small-scale agriculture. The ecosystem provides opportunities for largescale fishing and natural recreational facilities and tourism (BBN01 BBN2 and BBN3). Data analysis result reported that fishing is a major occupation practised by mostly male population of the local indigenes and other migrant fishers, supplemented with farming mostly at the subsistence level (BBN01, BBN02). The women aside from engaging in small-scale fishing, also explore other aspects of the fish value chain such as processing, trading and firewood gathering. Other identified income-generating activities include petty trading, boat transportation/driving, and technical and artisan works (see Table 7). Few of the community population are engaged by resident oil companies and other private services. The community has dormant oil wells and a major crude oil export terminal. Access to the community is currently only via water through speed boats, barges or canoes, or by air through helicopter.

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Figure 10: Map of Twon Brass Local Government Area, Bayelsa State, Nigeria



(source: Unknown)

Collectively, these communities (see Figures 8, 9 and 10) making up the survey interview setting supporting approximately 60 to 80 per cent of all plant and animal species in Nigeria, especially many endangered species (UNDP, 2006). Different survey respondents' evidence and consulted studies reported the presence of biodiverse species of wildlife around the ecological system that include beetles, butterflies, mosquitoes, ants, termites, Nile monitor lizards, parrots, antelopes, monkeys, bush pigs, buffalos, sitatungas, chimpanzees, African elephant, crocodiles, manatee hippopotamus, pelicans, bivalves, crabs, mussels, periwinkles, hermit crabs and deep swimming shags, variety of freshwater and saltwater fish species in this SES under study (IUCN, 2018; USAID, 2020; Ogbeibu and Oribhabor, 2023). Also, survey respondents identified different species of fish and aquatic life resources harvested from the coastal and marine ecosystem. The interview respondents reported fish

species such as Red Sniper, Croaker, Tilapia, Dolphin, Sharks, Hummer Fish, Tortoise, lobster, Octopus, prawns, periwinkles, snails and other local species such as "Balle, Soun, Nkpowi, Okpolo" that could not be interpreted in English language (IAN04, ORN03). The major categories of crops that respondents reported to be cultivated within the study area are edible fruits, seeds and stems covering, but not limited to palm oil fruits, rubber, cassava, yam, plantain, banana, cocoyam, coconut and several fruit trees, mango and avocado and a variety of wild medicinal plants (ORN10, ORN04).

Table 7:Description of First Level of Semi-Structured Interview Respondents

S/N	Survey Participant ID	Location	Gender	Status	Occupation	History of Resource Use *	Status in Community
1	ORN-01	Ogoni	Male	Single	Oil Industry Employee	10	Indigene
2	ORN-02	Ogoni	Male	Single	Environmentalist/ Oil Spill Clean-Up Worker	35	Youth Leader
3	ORN-03	Ogoni	Male	Single	PHD Student	29	Indigene
4	ORN-04	Ogoni	Female	Single	Oil Spill Clean-Up Worker	16	Indigene
5	IAN-01	Ibeno	Female	Married	Retired Soldier	10	Women Leader
6	IAN-02	Ibeno	Male	Married	Fisherman	66	Clan Head
7	IAN-03	Ibeno	Male	Married	Entrepreneur	60	Indigene
8	IAN-04	Ibeno	Male	Married	Retired Oil Worker	60	Community Head
9	IAN-05	Ibeno	Male	Married	Retiree/ Fisherman	25	Village Head
10	IAN-06	Ibeno	Female	Married	Fish Trader	24	Women Group Coordinator
11	ORN-05	Ibeno	Male	Single	Entrepreneur	20	Indigene
12	ORN-06	Ogoni	Male	Married	Oil Worker	40	Indigene
13	ORN-07	Ogoni	Female	Married	Oil Worker	10	Indigene
14	ORN-08	Ogoni	Male	Married	Unemployed/ Fisherman	39	Indigene
15	ORN-09	Ogoni	Male	Married	Electrician/ Farmer	40	Indigene
16	IAN-07	Ibeno	Female	Married	Civil Servant	36	Women Group Coordinator
17	IAN-08	Ibeno	Male	Married	Engineer	15	Indigene
18	IAN-09	Ibeno	Female	Married	Oil Worker/ Caterer	37	Indigene
19	IAN-10	Ibeno	Male	Married	Oil Worker/Fisherman	46	Clan Head

20	IAN-11	Ogoni	Male	Married	Oil Worker	25	Resident
21	BBN-01	Twon Brass	Male	Married	Oil Worker		Community Leader
22	BBN-02	Twon Brass	Female	Married	Teacher	10	Indigene
23	BBN-03	Twon Brass	Male	Married	Engineer	46	Community Leader
24	ORN-10	Ogoni	Female	Single	Environmentalist	14	Women Group Coordinator

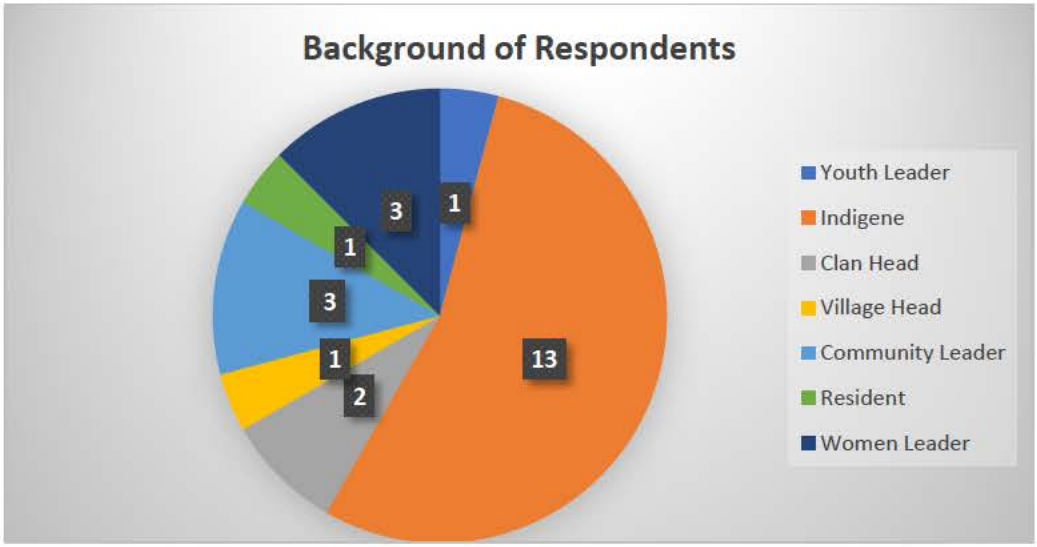
- History of resource used is defined by the number of years each respondent indicated to have spent in the survey setting.

Table 8:Description of Second Level of Semi-Structured Interview Respondents -Expert Witnesses

S/N	Survey Participant ID	Location	Gender	Status	Expertise	Years of Employment in the Oil Industry Experience	Current Assignment
1	OIE01	Warri, Delta State	Male	Married	Emergency Oil Spill Response	30	Oil Spill Clean-Up Supervisor
2	OIE02	*Port Harcourt, Rivers State	Male	Married	Health, Environment and Safety	23	HSE Advisor
3	OIE03	*Port Harcourt, Rivers State	Male	Married	Sustainable Development/Community Relations Consultant	15	HSE Advisor
4	OIE04	Port Harcourt, Rivers State	Male	Married	Industrial Health, Safety and Environmental	20	HSE Advisor
5	OIE05	Uyo, Akwa Ibom State	Male	Married	Petroleum, Environmental and Geochemistry	18 years	Senior University Lecturer, Geology/ Oil Consultant
6	OIE06	*Port Harcourt, Rivers State	Male	Married	Sustainable Development/Health, Environment and Safety	23	HSE Advisor

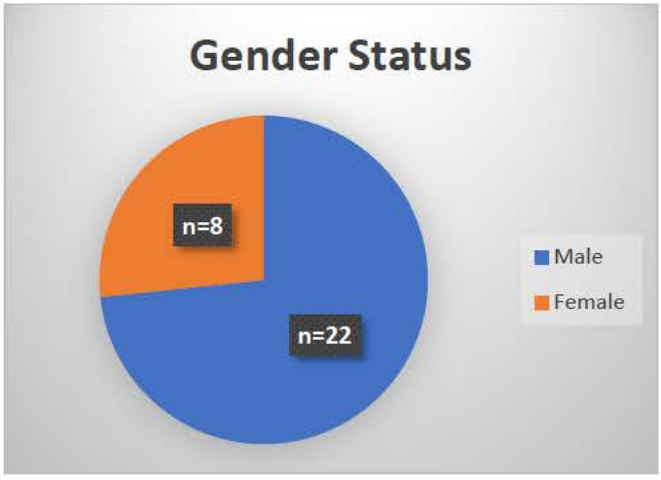
*HSE experts administrative base is in Port Harcourt, but operationally work around oil field installation located across different communities.

Figure 11: Background of Community Respondents



From the background of the interview respondents (Figure 11), out of the 24 interview respondents that participated in the field survey across the three communities, 10 hold leaderships responsibilities of different categories. Although, this could be indicative that these leaders represent a larger population based on their leadership role. However, concentrating too much on interviewing leaders could suggest a bias of gathered evidence non-representativeness of survey setting for a study epistemology gathering multiple perspectives. However, because two layers of field survey in the qualitative segment, all analysed together, the evidence from the experts' witnesses (some of whom are in some cases resident in the survey settings) could control such bias if they arose. Nonetheless, the survey generated exhaustive evidence with depth and broadness for analysis.

Figure 12: Demography of Survey Respondents



6.3 Female Participation the Survey

From Figure 13 above, although the ratio of females to men interviewed was 27% to 73%, it should be noted that IAN01, IAN06, IAN07, and ORN11 represent thousands of women as different women group coordinators. For emphasis, IAN06 coordinate the all-women fish trading group in Ewocha supplying fish and seafood products to people in every village around the 21 LGAs for resale in their villages. While ORN11 coordinate social groups comprising over a thousand women currently engaged in the oil clean-up rehabilitation of the mangrove forest in Ogoniland. Although, IAN01 provided evidence that suggest the attrition of proportionate women in the survey interview. For example:

> *"You know in African culture, they don't really recognise women, it is men, youth and all these types of people. So, me I respected myself. I don't go out. I don't want problems"*

This evidence might suggest the patriarchy in the survey setting. But the number of women survey respondents sometimes reported on behalf of their women. For example, according to IAN01: "

I have a group of women that we use to meet, like cleaning of the village month, we §gather women we do clean-up, and the name of the organisation is Ujo Ikpeni Ibeno."

Also, IAN06 participated in the survey interview with other women speaking in low tones in the background. Also, she frequently made reference to 'our' in most of her evidence for example:

"some of 'our' women when buy food stuff such as Mango, or garri (processed cassava). 'Our' people that are trading in that business find it difficult to buy fish. It is only fishing trading is 'our' only occupation. 'Our' women are dying young." (IAN06)

Likewise, ORN11 commented that:

"I have also made some input in the political arena and here I am today leading women at the grassroots. Working with women, building movement that can bring about environmental justice."

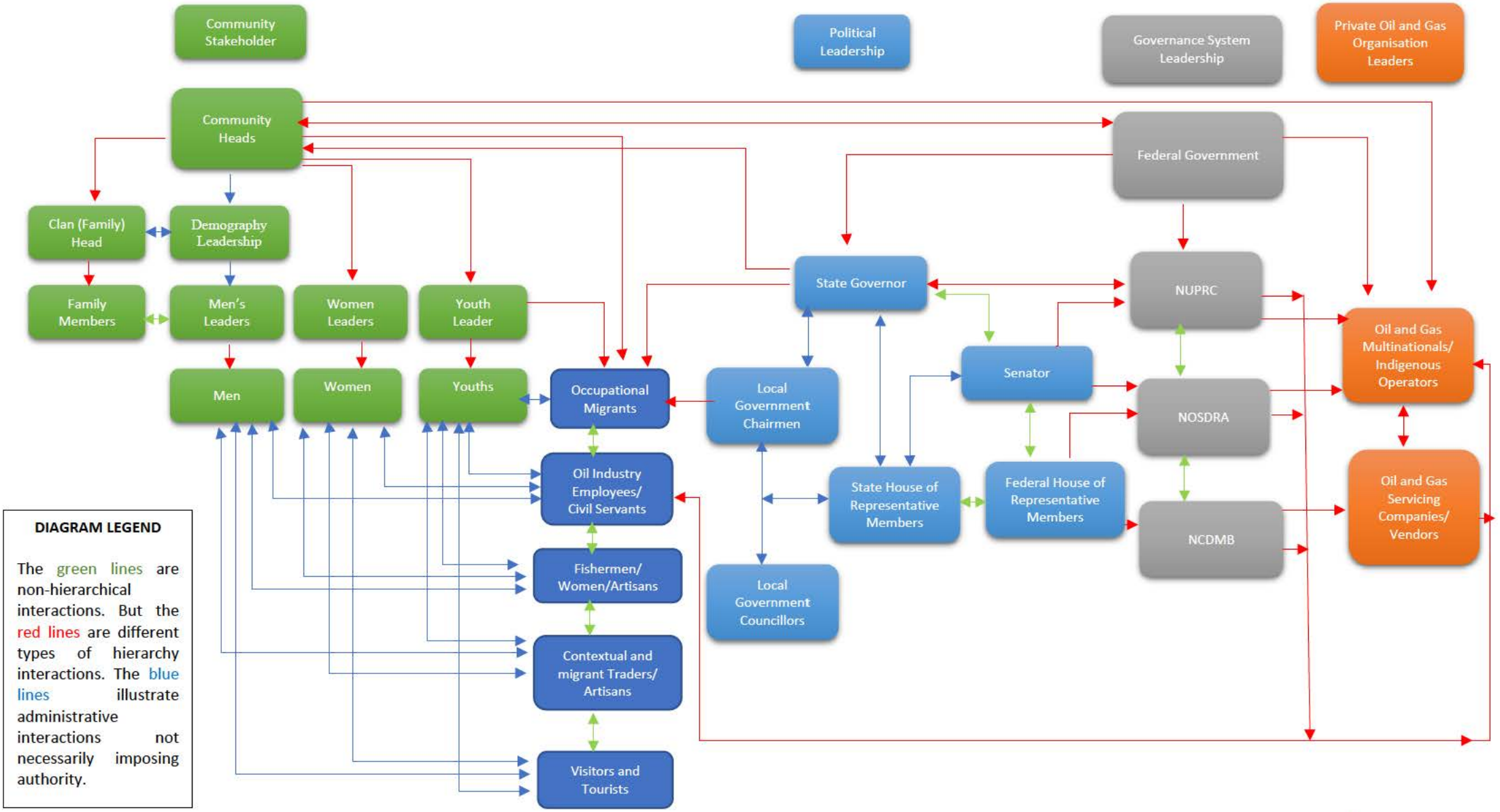
Although the survey could not achieve the targeted gender balanced evidence proposed in this study, the participation of different categories of women leaders suggest that their evidence is representative of a larger female group than were reach during the field exercise.

6.3.2 Interaction

The interaction within the SES from which the outcome emerges in the survey context is mapped in Figure 13 based the researcher deduction from the survey evidence. These interactions are mapped from the first and second segments survey evidence illustrates the multi and crosscutting action situation interconnecting the different SESF variables in different networks of interactios at multiple levels and scale, contributing to different outcome effects that is reflected in the data analysis. This Figure 13 is considered empirically relevant provide a preliminary background evidence on the scale of complexity on how the

variables interact within the SES. The green lines are non-hierarchical interactions. But the red lines are hierarchical interactions depending on the institutional authority (informal or formal institution) represented. The blue lines illustrate administrative interactions based on administrative relationships not necessarily imposing authority.

Figure 13: Visual Map of Social Actors' Intra and Interaction in SES Around Oil Mining Fields Based on Survey Evidence



6.3.3 Emergent Themes and Sub-themes

6.3.3.1 Theme 1 - Natural Resource System Dependent Livelihood

1. Land-Use and Food Production System

Evidence from the survey evidence suggest the ecological system is important for land use, serving as a habitat for human populations and shared communal activities, farmlands, natural resource extraction, safeguard for their aesthetic beauty and geographical uniqueness. For example, evidence from each all survey interview agree that terrestrial ecosystem occupies a unique position at the intersection of crop, wild plant development and food cultivation that support human and different species of animal sustenance. From the evidence on geographical configuration has heard survey respondents 'boast' about and describe their natural resource system attributes to the point that three respondents confirm the resistant from leaders and community members of Ibeno on a recent attempt at remapping geographical borders by Akwa Ibom state government (IAN04, IAN06 and IAN09). The respondents reported that they insisted their ancestral land and the revenue proceeds (in the form of subvention to local government authority) accruing from oil resources extractions would not be allocated to another local government under any circumstance. To protect the geographical integrity of their land, (IAN04, IAN05) reported their community leadership approach of The Office of the Survey General delineating geographical borderline in the country to reaffirm the historical boundaries of their communities. Based on the perception of the political discrimination in restructuring the local government authority (LGA) against the affected social group suggest the intention of the exercise as an avenue to redistribute their economic wealth. Also, a 35 years female leader of fisher trader's association (IAN06) reported that:

"We have 21 LGAs, then the government of Udom (the past governor) decided to divide Ukpenekan, Ewocha and Ukpena to Eket because of an oil multinational. Then Akassa, Itakpe, Iwokpo and divide it to Unna so that the 20% (host community grant from the new oil law) that they are giving to Ibeno they can other LGAs"

Thus, in fighting back using institutional supremacy, a 60-year-old retiree, presiding over a local church as an archbishop (IAN05):

"our community took the case there (the Surveyor General) to be able to retrieve the actual map of our community to show that actual map and the boundary have been existing."

A female oil industry engineer and a caterer processing fishery and seafood products (IAN07) who had lived in the community since birth said they were *"vowing to lay down their lives"* against any form of encroachment on their land. However, it was surprising that none of the respondents reported political support by the leadership of the Local Government Authority (LGA), which is the formal institution closest to the local communities. Yet, the supremacy of the centralised petroleum over land-use law and customary acts and the discretionary power accorded to the different political office holders suggest that property and economic rights are limited to the legal authority of formal institutions. This suggest a practical illustration of the colonial era institution restructuring that alienated pre-colonial customary rights (see Chapter two). Notwithstanding this case of competing different categories of property rights, other survey evidence suggests that the consequences of oil mining overlap beyond the different property rights to the confines of the ecological system represented by the terrestrial, coastal, and marine ecosystems where different social actors source their sustenance and livelihoods. For example, survey respondents reported that:

"But we been at the seashore because most of these oils are not been attended to, they now move from these other LGAs or these other communities towards our direction because of our sea." (BBN02)

"There is oil spillage and a lot of other things that affect the water, so it makes the fish to be too close to the shore any longer. The fishes have migrated further into the water." (IAN07)

"But, come to see now. The spills have destroyed all our vegetational belt, we cannot do fishing, for the fact that there is no fish to catch, all those our fishing gear because we are predominantly fishermen, we have not gone mechanised, we use hand pulling boats, all our hand pulling boats are destroyed." (IAN04)

This evidence suggests the inestimable measure of oil spillage contaminating the ecological system. Thus, a good starting point for exploring the social-economic system outcome in the survey setting is assessing the influence of oil mining on the diversity of human, animal, and plant species for habitat, food, nutrients, and medicinal plants in this SES around oilfields.

2. Social Perception on Farmland Pollution and Food Production

The terrestrial ecosystem includes land, and soil that contains a mixture of solids, water, and gases with a diversity of microorganism species; which can be valued based on all aspects of its quality and capacity to support plant cultivation (IPBES, 2019). However, the survey evidence on the linkage between soil, plants, animals, human productivity and the externalities from oil mining have generated different experiences. The issue of oil pollution is reported to hamper natural resource system value extraction by social actors that are grossly dependent on the social-ecological system for sustenance and livelihood. For example, an international United Nations-recognised local women group coordinator (ORN10) reported that she currently mobilises over a thousand women who because they

lost farmlands are participating in the ongoing Mangrove Forest Restoration Project in Ogoniland as alternative livelihood source. In describing the natural resource system, she reported that:

> *"we have our staple food, cassava because we have good land, we used to serve as the food baskets of the region, we also serve the sub-region of Nigeria, spanning the eastern region and all that because there are things from Niger Delta that the easterners were buying for their survival until oil pollution came about. We don't play politics with hunger. You imagine that an oil spill has affected someone's farmland, affect someone's fishing pond or Periwinkle pond for instance and then when you come in rather than talk to them you ignore, bypass and then go meet a chief and the end of the day an exalted individual in the community. No!" (ORN10)*

Similarly, she confirmed that wild medicinal plants, particularly Okazi or Afang leaf (Gnetum africanus) and Bush Mangos (Irvingia Gabonensis), are common on household menus because of their curative ingredients. These medicinal plants also have revenue potential through supply to subnational states and neighbouring countries as staple food, but these wild plants are often lost to oil pollution. Also, a process engineering resident (ORN08) working with one of the oil multinationals complained about:

> *"Like what we are saying because of the exploration of oil, gas flaring and the rest of others these crops do not yield well the way it is supposed to yield like cassava, okro and the rest of others, corn. So, but before when they plant at the upland side, it yields and they harvest to eat some and sell some." "Our land was producing – in Rivers state, it was our land and local government areas in particular that produce fruits, yam, cassava. But now there is nothing coming out of the soil again because of the pollution from oil." (ORN08)*

Other specific cases of farmland pollution from oil and gas activities were mostly reported in Ogoniland where farming is more prevalent. For ecample:

“The farmlands were no longer fertile for crops to grow.” (ORN07)

"...On farming, because crude oil spillage has contaminated the soil, we don’t make as much money that we used to make before.” (ORN09)

“Even, those on the hinterland, once there is a spill, you know as it spreads, it spreads on the land. All the crops, and vegetation die. In fact, you need to see a spill site. Every plant there will die. And you won’t be able to cultivate on the land for a number of years until there are clean-ups. And it takes time for the environment to be regeneratable.” (OIE06)

“If you go to the Ogoni area that they stopped the production of oil for a while, they produce very rich farm produce. The size of yams they harvest very rich, corn very rich and all that. But as soon as oil exploration starts within that region you can be sure those outputs will not be as it is currently.” (OIE03)

“People were happily farming in good ground, fishing on good water bodies, where there was no oil pollution. They had little or no idea about oil present in their environment. But when this oil exploration came up, farming became devastated because of failures of infrastructures. The pipelines were beginning to fail, and the oil that was sipping from the pipelines, they did not just contaminate the water bodies, they moved as far going to land, entered people farms. The little piece of lands that were not touched by those oil explorations, that were not contaminated they are managing on it. Okay it is difficult for the whole family to depend on little piece of land. Now the produce that they were producing by themselves, some of them have resorted

to going far and wide to buy those things that they were able to produce with their hands to sell in the community." (ORN04)

Exploring this survey evidence suggests that the impact of the consequences of oil mining on people's sustenance and livelihood even though the property rights are well delineated in by natural resource management institutions. Besides the evidence of respondent reports of oil pollution in the natural resource system corroborated the available evidence in previous studies (UNEP, 2011, Sentamu et al; 2023).

If the sustainability of human sustenance and livelihood sources is connected to the natural resource system productivity as reported by the survey evidence, it suggests that oil pollution alteration of the social-ecological system threatens food crops cultivation, food security, employment and income of local social actor's dependent on it. Nevertheless, the relationship between farmland cultivation, crop productivity and harvest may be influenced by other geographical factors, such as soil type, soil moisture, season of cultivation, type of soil nutrient enhancers and amount of water supply to farm. Contrary some survey evidence in this study suggesting the consequences of oil mining as the major threat to natural resource system productivity, other evidence of human actions in the context such as alluvial sand mining and forest lumbering can equally impact ecological system condition. For example:

"And other people from nearby LGA equally come to buy the sand from people who remove sand from the water there and they use it for land reclamation, road construction and the rest of others" (IAN08).

"I talked about the crude oil, the sand, different kind of sand that people mine in our area" (ORN10)

"After from say, fishing the sand beach. I think you know the sand beach those are the one they use in road construction, for filling and building of houses. And that sand is

also used for manufacturing glasses. Since they don't have that type of industry, but I have since people either Chinese coming to take that sand." (IAN11)

"You know we are really blessed with the mangrove forest. So, they saw these woods, these woods are of blessed economic value to us. And in fact, to the country because on daily basis you see that they come with trailers, it is becoming an adverse effect as well because of global warming because they are not supposed to cut the forest because by the law when you cut down one tree you expect them to plant more than two. Whereas it seems blessing is turning as adverse effect because the wood from this mangrove forest is cut. Off course, it does add income for people known for selling of woods and it is these trees around the community that they cut for such purpose. And also, that is also an additional source of income." BBN03

Nevertheless, the issue of farmland pollution from oil mining can often be speculative, several survey evidence from this study has reported its different degrees of value losses impact for local farmers in the SES. Despite these farmlands and the mangrove forest degradation, local farmers still depend on the natural resource system for cultivated and wild crop harvest, food processing and supply as sources of household income.

From another evidence, the perception of oil pollution on farmlands also generates private costs for oil companies or regulatory agencies responsible for pollution clean-up, the soil remediation process, disposal of polluted soil, and the time and revenue lost from interruption soil cultivation. For example, an initial payment of $1 USD billion to the Hydro Carbon Pollution Remediation Project (HYPREP) paid for by the federal governance and an oil company after a court judgement is currently ongoing in Ogoniland for the first five years (UNEP, 2011; CBN, 2016). Another case study of the direct cost of oil spillage on the SES based on evidence from (ORN03), and corroborated by published evidence (Leigh Day, 2015) reveal

that an oil multinational was penalised £55 million distributed as £3,000 to each of the 15,600 Ogoniland claimants in 2014 based on (UNEP, 2015) assessment of the social-ecological system condition. Although these compensations represent different degree of revenue loss to the oil mining social actors, regulatory actors representing the natural resource management and the local social actors depending generally on the ecosystem for sustenance and livelihood in the context. However, it is important to also evaluate often non-explored economic cost SES degradation which may not capture all the dimensions of the natural resource value in the context. For example, whereas it is difficult for compensation to fully account for the other spill over effects on social-economic system of local cultivation, supply and sale of foodstuff, employment provision, recreational value and social-cultural value of the ecological system that support the broader and social-economic system. There currently no comprehensive framework for calculating natural biodiversity including known plant, animal species and unknown genes loss to oil mining activities. Besides, how can empirical process capture disruption of ecosystem services such as photosynthesis, nutrient recycling, decomposition or filtration. Meanwhile, available survey evidence reveals some residents awaiting delayed compensation payment from oil multinational governments, government or NGOs, seek low-wage employment from oil companies, or migrate to urban centres with better opportunities (IAN05, IAN11, ORN10). What can be deduced from these evidences is that, where the full accountability costs of oil mining externalities are not assessed and paid for around oilfields, oil mining private costs are transferred to the general public through contamination of the ecosystem that people depend on for sustenance and livelihood.

3. Social Perception on Coastal and Marine Ecosystem Pollution, Fishery Products Harvest and Food Production

The prominent value of fisheries and other aquatic products was explored based on the social actor's perception of their contribution to livelihood sources, employment opportunities, entrepreneurial drive and the cultural value attached to the ecosystem as deduced from the interview evidence. For example, the coastal and marine ecosystem with a diversity of plants, animal species, and humans were discovered to contain natural resource units that support freshwater supply, shoreline protection, natural recreational facilities, climate regulation, and sustainable livelihoods. Survey evidence suggests that the majority of the social actors in the survey setting are engaged in fishery products harvest for subsistence, livelihoods, or based on cultural attachment. Also, survey evidence suggests that fish processing and trading employ women and youths in other aspects of the fishery value chain. Selected evidence from verbatim evidence provides more clarity:

> "*Sometimes women like me selling the products do have enough commission after all the labour of drying the fish, going to the market and you generate about 1000 naira or 1500 naira and buying firewood from a distance. It is only fishing trading that is our only occupation. …and our daughters when they return from school, if they don't have a job they follow us" (IAN06).*
>
> *"In the fishing aspect also, when you go and buy, you buy from them, after taking them to the market, you might not even take it to the market, you can still stand around the waterside and sell it to take care of your family." (IAN07)*
>
> *"I am a process engineer, I am also a caterer. So, while working I do involve in little other businesses like trading, and selling of fish, seafoods like oyster, sea snails etc." When you come here you will see a whole of people busy selling their fish. Our people are very hardworking, they are busy with businesses." (IAN07)*
>
> *"All our occupation here which is predominately fishing and farming." (IAN04)*

This suggests that for the human populations of this SES, the coastal and marine ecosystems serve as both sustenance and livelihood sources, as an important source of food production, employment, and livelihoods, with implications on households' income and community economic condition.

From the survey evidence, despite the centrality of coastal and marine ecosystems linkage to sustenance and livelihood for the social actors, these ecosystems also have social-cultural values based on traditional knowledge. For example:

> *"But, my dad also engages in fishing at times. My father had a portion where he fished. Sometimes he goes to the fishing port to get fish for the sustenance of the family and sometimes sold some as part of help (additional income) because he could not depend solely on his salary paid by the government". (IAN09)*
>
> *"Prior to this time that I have told you, like my late father he was a fisherman. At that time when we were using pounds before it was changed to naira in 1973, my dad could as early 1950s, make 5 to 10 pounds a day. That could make him build a comfortable home as at that time, train all of in school up to the university." (IAN04)*

Additionally, IAN04, BBN01, ORN05 and IAN07 provided evidence the migration of other occupational fishers from the Ilajes and Yorubas (southwest, Nigeria), Beninese and Ghanaians who relocated these communities to explore fishing opportunities in the SES. This evidence suggests the local social actors' ratio of dependency on the coastal and marine ecosystem for sustenance and livelihoods and the social-economic potential. Moreover, survey evidence from respondents' estimates of their income from fishing suggest an average of about N50,000 (26.32 British Pounds) monthly or more. This income is much higher than the country's current minimum wage of N30,000 (15.80 British Pounds) (NLC, 2021). Also, a

local community chief and a public servant (BBN03) who has lived in the Brass Kingdom for over 5 decades said that:

> *"Such persons will probably earn about even 100,000 or 50,000 naira per day depending on the harvest for that day. But on the average, they would make even 200,000 naira for the week as the case may be to describe the income of fishermen(women)." (BBNO3)*

When compared with "*other menial ones that they cannot get even up to 20,000 naira" (BBN03)*. As commented by a community head in Ibeno (IAN04), He added,

> *"…the jobs that are mostly been offered to our people are minor jobs. When I say minor jobs, I mean minor jobs. You see a man claiming that he is working in a multinational company and he is receiving a salary of 35,000 naira.". (IAN04)*

To emphasise the social-economic potential of the fishery and sea food occupation, artisanal fishers are suggested to produce enough quantity to feed a population of about 3.9 million in Akwa Ibom State (NPC, 2006) as reported by (IAN11). In his words,

> *"statistically, if you check very well the seafood produced from Ibeno is the seafood that is feeding the entire Akwa Ibom state." (IAN11)*

Despite the social-economic value, the fishing occupation in competition with oil mining as source of revenue to households is been continually threatened by oil mining that has been reported to repeatedly contaminate the coastal and marine ecosystem. While cases might vary, oil mining contamination of these ecosystem suggest the unpredictability of the income level for households and the broader community. Yet, the oil mining organisations and their workforce who depend on the drinking water, fishery and seafood supplies for daily industrial and domestic feeding and nutrient supplements are also beneficiaries of this resource system (IAN09). This is even though other factors such as weather conditions (tidal

movement), seasonality of harvests, and individuals engaged in different income stream have been reported to influence fishing and harvests. Nonetheless, the unpredictability of this natural resource system poses different challenges for sustenance and livelihood sources to households grossly or partially depending on the ecological system subject to the economic condition. From an respondent stated that:

> *"Then my dad was a civil servant. But, my dad also engages in fishing at times. My father had a portion where he fishes. Sometimes, he goes to the fishing port to get fish for the sustenance of the family and sometimes sold some, as part of help (additional income) because he could not depend solely on his salary paid by government. So, he felt as a family with much responsibility and the commitment, so he has to engage in other means of brining or diversifying ways of getting money to raise the children. So that was why he engaged in fishing whilst still working as a civil servant." (ORN05)*

Besides, on the people who are grossly dependent on the natural resource system, evidence from the perception of respondents from experiences shows that: *"Sometimes we had a spillage and the spillage flow into the rivers, fishes were dying, and fishermen can't fish." (ORN07)*. Yet, the category of people the oil industry in Ibeno reportedly employs are: *"What they will normally do is to employ our people as the commissioning of odd jobs to sweep the oil or mop the oil."* (IAN04). But, *"The spills have destroyed all our vegetational belt, we cannot do fishing, for the fact that there is no fish to catch." (IAN04)*. With a high dependency on natural resource systems, the survey respondents frequently complained about the consequence of oil mining, ecosystem pollution, fishery products harvest challenges, hunger, income, unemployment, poverty and governance system negligence. The evidence below reflects the perception of a respondent from Ogoniland:

"The most difficult problem I see in my community right now is poverty. Why I mention poverty is because who don't have white collar job and were depending on the environment to survive, they are no longer able achieve anything. So, as a result of this poverty of and hunger is one of the challenges out of many. The second most difficult challenge in my community right now is that damaged environment was engulfed by oil spill. Poverty as a result of the damaged environment." (ORN06)

Meanwhile, evidence of unemployment as a result of the decline of the natural resource system value also identified from the survey exercise, could also suggested to reflect poverty. Nevertheless, qualitative evidence suggests unemployment is a difficult problem in the survey context. For example:

"*They pirate that you may see around here, is because of no job." (IAN04)*

"So, apart from that I would urge the federal government to please advise the IOCs and the NOCs to give to the community their quota in the area of employment. Employment is the important thing that we are talking about, apart from development." (IAN10)

"Then in terms of that, what they do is that they engage them in some skills acquisition programme in terms of unemployment issues. So, they will be able to have something meaningful to do with their lives." (ORN03)

'…the rate of unemployment is still on the increase. Three, there is competition for the limited resources." (ORN01)

So far, contrary to the rich endowment of coastal and marine resources in the survey context, evidence of some respondents withdrawing from the fishing occupation or being partially involved because of the dwindling harvests suggest the level of ecosystem disturbance near the oilfields in the survey context (IAN04, IAN05). However, IAN05 responded, *"Because of*

the high cost of things, the pension is not enough I am planning to go into other businesses to be able to augment my income." In a particular evidence ORN10 reported that:

> *"oil companies don't have their business operations or administrative offices around that area, it makes people to be highly unemployed. Even though we have a high level of graduates, but they don't seem to have a job to fit into. In fact, that is part of why you hear about insecurity, youths fighting and all those. The youths are idle." (ORN10)*

The factor influencing the problem of unemployment from the perception of the survey respondent is suggested as a decline in their fishery products harvest over the years because of the consequences of oil spillages and gas flaring. Survey evidence from a respondent reported that:

> *"Some of those challenges are the oil pollution which we do not allow us to fish from the shallow waters that our forefathers used to fish. You will now be going so deep inside the Atlantic Ocean so that you can make a good catch back home. And in the process of going to the Atlantic Ocean, you must have an outboard engine which is very costly now. As far as this country is concerned you know things are hard, for you to have more than three million naira (1,580 British Pounds) to buy a 40-horsepower outboard engine, you know what it means. These are our challenges. And especially now that fuel is not something that poor man can be able to afford. You know before you go into the Atlantic Ocean to fish, you must have a substantial amount of fuel in your container. You knew to have at least two 50 litres of fuel in your boat if you are doing crayfish or large, big fishes." (IAN10)*
>
> *"So, when the income from fishing reduces, how do you survive, what do you now do to make additional income?" "...Because most of the fishes are no more found. This oil spill has driven the fish far. We used to catch fishes by the bank of the river. We place*

net or hook by the bank of the river. But now we have to go deep into the sea. But the catch is not much as it used to be. It affects us serious." (IAN05)

"When I was a little child my mum told me that in the morning between 6 am to 9 am you can generate between 10,000 to 30,000 naira (5.30 to 15.80 British Pounds) within 2 hours because the fish was much so there was no need troubling the sea. But now it is not like that because oil spillage affects the water. There is an oil spillage and a lot of other things that affect the water, so it makes the fish to be too close to the shore any longer. The fish have migrated further into the water. So what people can generate in a day highest (maximum) is maybe like 10,000 to 20000 naira. (5.30 to 10.53 British Pounds)" (IAN07)

Although the social perceptions evidence indicates fishing as a major source of sustenance and livelihood for some people as occupation inherited from their parents, while other occupational engagements are to supplement income from paid employment. However, the consequence of oil mining cam arguably be suggested as a major threat to sustenance and the livelihood sources despite the presence of three level of formal regulatory institutions, supplemented by oil industry best practices prescriptions, informal institutions domiciled within local communities, civil liberty organisations and other international multilateral agencies enforcing governance system and advocating for social-ecological system safeguard. Although, these social perspective on the linkage of the natural resource system to social-economic system based on the condition that is not commensurate with their expectation. However, these pieces of evidence will be complemented and corroborated with the questionnaire survey evaluation as well as available secondary datasets.

4. Social Perception on The Nutritional Value of the Fishery and Aquatic Life Sector Impact on Social Actors

Survey evidence reveals that there was no other source of animal protein except fishery products when providing evidence on food consumption. For example, one of the survey respondents, an engineer and a retired community youth leader (IAN10), confirmed:

> *"That is what we are using to support ourselves and livelihood of our individual families. So, you go out for fishing, you fish and come back, you remove some fish for your family to cook, while the other proceeds you make from selling these fishes, you know use it to support your family. …that is no pattern of food you cook without fish. …, even if you want to eat rice, you want to eat, whichever thing you want to eat you must have fish." (IAN10)*

Also, IAN07 responded to their ecosystem endowment by saying, *"you can use 500 naira to prepare soup with any fish you of like"*. But ORN08 said *"now we can go fishing in the river from morning until night time and not have any catch for cooking a meal…"* Also, ORN06 talking about himself, said, *"you fish and by the time you return home, you have to sell and equally something to eat and cook soup."* Interestingly no other alternative source of animal protein was mentioned across the survey evidence or discussed as part of survey respondents' local diet, despite the reported concerns of the contamination of coastal and marine ecosystems from the consequence of oil mining. Alternatively, the proximity of the survey setting to coastal and marine ecosystems may contribute to why fishery products are suggested as the cheapest sources of animal protein as indicated by IAN07 who responded that "*you can use 500 naira"* (about 4 British pence) to prepare a meal that includes fish. She even reported that "*someone could be gifted a small amount of fish to prepare soup if you could access the waterside during offloading from trawlers"*. Thus, the implication of the loss

of access to fishery products harvest might also suggest the loss of nutritional animal protein value may be reflected in the food production system, income as the cheap sources and faster access to animal protein and the social well-being of people depending on low-fat animal protein for sustenance.

5. Social Perception on Oil Mining Impact on Freshwater Drinking System

A fundamental discovery in the evidence collected during the interview was about the contamination of freshwater systems such as creeks, rivers, and springs that people depend on for sustenance and livelihoods. For example, a local engineer (IAN08) employed by an oil multinational indicated that:

> *"So, the place is hell; they get drinking water from neighbouring towns; all this pure water (packaged sachet water) comes from Eket and other LGAs, Uyo; that is where they bring in bottled water for the people living around. Even in the IOC, that is what they drink. (IANO8)*

Also, IAN09 reported that:

> *"our drinking water is acidic because of the flare. You can't drink it, it is no longer natural water. It is not good for the health." "We have boreholes in our backyard, and the water is not good for drinking. It is just like coffee, Lipton tea. You can fetch the water and live for up to three or four days (to settle down) before you can use it to bath." (IAN09)*

Unfortunately, a local Ogoni lady (ORN07) revealed that:

> *"I told you that some rivers have been contaminated. I think prior to that; some people didn't know that some rivers have been contaminated. So, since there were no other sources of water, some people took the risk to still drink the water. One of my relative's*

children died from drinking that water. Nothing was done; no government official came; everything came back to the status quo as if nothing never happened." (ORN07)

Also, ORN06 lamented about health complications and commented that *"if they can tell you the number of people that died, people died on a regular basis because of the incident."* (ORN06) Despite the evidence on oil mining activities pollution on the freshwater system gathered from the field survey highlighted in this analysis, there is other pieces of corroborative evidence on water contamination already analysis on other themes and subthemes (IAN04, IAN11, IAN07, ORN03, ORN05) to keep the word count of this thesis manageable. However, an Ogoni man running a small business (ORN05) recommended that:

"another thing is that one of the challenge factors is that the government ought to provide pipe-borne water for them to drink so that they can be prevented from having all these terminal diseases because it is not everybody that are financially buoyant enough to sink a borehole." (ORN05)

However, in the response to oil spill monitoring and clean-up expert interfacing between the oil spill-up agency where he is employed and different local communities on oil spill clean exercises (OIE01) reported that:

"For instance, let me tell you, you will be shocked that some of those communities drink the water from the river around them. So, imagine that water being polluted, that means the people can't find water to drink. It becomes a problem. Can you live 24 hours a whole day without drinking water? Some of those communities don't even have a good source of convenience (toilet). They still do that in that environment. So, their life revolves around the water channels and so if there is a disaster or a negative impact as a result of these oil miners, it will affect the economic life of the people. Their

health, of course, you can find epidemic situations here and there and diseases. And some of them don't have hospitals, so what do you expect?" (OIE01)

Additionally, a former United Nations consultant, geologist, and university lecturer (OIE05) reported that *"I have had the opportunity to work on the surface and borehole water around there. You will see that it is quite contaminated, especially with coliform faecal contamination and also Benzene."* Also, a local business in Ogoniland (ORN05) reported that *"so, some people dug a well that they use for drinking, I think all these things are not okay because the soil is contaminated. So, a lot of environmental pollution, so they don't need to drink the water of the level."* Likewise, an environmental scientist working with an oil spillage clean-up in Nigeria (ORN06) reported that *"what I am trying to say is, currently there is benzene and the water table is no good for consumption."* Unfortunately, aside from the reported evidence of oil mining pollution of the freshwater system, there is another evidence of open defecation on the water bodies as reported by a local community chief (BBN02) and two expert witnesses (OIE01 and OIE06) that many respondents did not talk about during interview. Yet open defecation poses a water contamination challenge in these communities.

A major implication of the contamination of the water bodies either by oil pollution or faecal contaminant from open defecation remains is the health implications of households consuming these waters for drinking, bathing and cooking purposes. Whereas these people can adapt to the issue of the contamination of water from alternative sources or nearby communities. But in the natural biodiversity comprising different plant and animal species depending on the freshwater system hardly have other alternatives than to be impacted by the contaminant to migrate to cleaner ecosystem. Nevertheless, this challenge generates health concerns about fresh fish and seafood harvest, processed food and supply to the unsuspecting general public in bigger urban centres and neighbouring countries where people

come to procure these food products. Besides where these social actors invest in digging a well or drilling a borehole, there is the financial constraints on the household income or micro-community economic investment that can serve other purposes. Thus, whatever the source of contaminants on the water system in the survey context, the household, ecosystem and the national economy are worse off because of the imposition of unnecessary direct and indirect economic effects on freshwater purification or alternative sourcing. This evidence of freshwater contamination has been corroborated by secondary sources such as UNEP (2011) study in Ogoniland (UNEP, 2011) and Sentamu et al (2023) in Bayelsa State including Twon Brass Kingdom.

6. Natural Social infrastructural Facility Condition

The natural social infrastructural facilities comprise different natural resource units within the ecosystem that include land use for building houses, clean air that people breathe, waterways for coastal and marine transportation, unique geography that attracts tourists and other natural resource uses for recreation. Many respondents shared with pride the biodiverse configuration of their natural resource system, which serves as a source of inspiration, rejuvenation, and livelihood. For example, ORN06 reported, *"There are times you equally go there for swimming and other activities. So, as a young boy as at then, you enjoy the scenery; enjoy that environment." (ORN06)*

Also, (IAN07) who coordinated multiple women groups in Ibeno reported that:

> "*tourists from different cities in southern Nigeria travelled down to enjoy the sandy beach waters in Ibeno mostly on weekends and during festive seasons."(IAN07)*

Then, a local private school teacher in Brassland (BBN01) reported that; '*they visit an adjoining town still part of Brass Kingdom to enjoy the beachside in an adjoining community, Okpoama."* (BBN01)

From another perspective of land use in Ibeno, for buildings, IAN11 and IAN08 reported incidents of gas-flaring combustion particulates (soothes) on rooftops that corrode roofing sheets made from zinc. Then there is the perception that heavy vibration of the earth surface from gas flaring causes landscape and houses around oilfields to shake, which eventually contribute to cracks in some houses in communities in Ibeno. For example, ORN08, a process engineer and resident working with one of the oil multinationals, and IAN03 a sixty-year-old building contractor complained that;

> *"when we say gas flaring many times people come around the air we breathe is no longer clean air so it is about polluted air. So, but you need a digital air monitor meter to know if the air is clean or not. Air pollution through gas flaring is the number one enemy within the area of the beach." (ORN08)*
>
> *"It is vibrating from the ground. Everywhere is vibrating, including the door, everywhere in the house. For example, if you place a pencil on a still table, you will see it shaking. And someone told me about the resultant effect of vibration on health. I had to relocate." (IAN03).*

When asked the question on the perception of what was responsible for this, he quickly identified oil mining activities from the oilfields around the community. For example, a resident engineer that has lived and worked as a contract staff with an oil multinational for about 25 years in the community (IAN011) reported that:

> *"And the vibration from the flare you will feel the impact. We living here, the vibration from the flare you will feel the impact. Most of the time you will hear the window just shaking "gbidi, gbidi, gbidi. (*Mimicking the sound of vibration*)" So, all those things are the effect of the flaring of those gas and other things." (IAN011)*

Although, the researcher is not aware of the relationship between gas flaring and the vibration of the landscape, but three respondents relate the experience with the incidence of gas flaring. For example, a 37-year-old businesswoman (IAN09) provided a more elaborate explanation by sharing an incident;

> *"There are these police that they transferred from Ikot Ekpene, sorry from Mkpat Ene down to Ibeno. So, the man now came got a place, as someone that is new to this place, he wasn't aware of effect of the flare on the land of Ibeno. So, when he slept he heard things vibrating, so he now stood up and starting screaming. Everyone was wowed asking what happened. He said that witches came to his house. They asked him how. He said the house was shaking and vibrating. So, we told no, it was the flare that was causing the house to vibrate. The thing was funny but I felt bad that we are going through this. If you come to our house some places have cracked. If care is not taken the building may collapse." (IAN09)*

From my understanding, the police officer who never experienced the vibration before that time, felt that there were some mysterious spiritual forces influencing the vibrating of the house that night. He however, understood better after his neighbours provide clarity from their historical experience of living in the neighbourhood. Similar to the evidence shared by (IAN09), another IAN07 living in this same neighbourhood share her experience:

> *"So, when he slept he heard things vibrating, so he now stood up and starting screaming. So, you can see that the gas flaring affects our roofing. Before some time, before you know it the roof will just get spoilt because of the flare. And not only that, because they are drilling out this oil from the ground, it affects our building, it racks the house because it will be making some noise – gbu, gbu, gbu, gbu – vibrating in the house." (IAN07)*

From the perspective of these survey respondents, the problem suggests communities near oil drilling and gas flaring site seem to experience the manner of earth surface vibration. Nevertheless, the social reality of earth vibration from oil drilling and gas flaring may suggest the value loss to the natural social infrastructure facility (such as land use as play field, coastal and marine ecosystem for water transportation and recreation because the vibration) that support social wellbeing and recreation. Although the majority of the survey evidence may be indicative of the consequence of oil mining on the SES, however there are the consequences of alluvial sand mining, mangrove forest depletion and open defecation on the water bodies which are the non-oil mining impact on the natural resource system condition. From the reported impact of human interaction with the social-ecological system for sustenance and livelihood sources, survey questionnaire will corroborate this evidence to evaluate its economic effects on household's income, community economic condition and its possible spill over on the national social-economic system.

6.3.3.2 Theme 2 - Governance System Perception

1. Effectiveness Level of Governance Enforcement

Governance systems encompass the set of institutional systems and structures designed to moderate the multidimensionality of the natural resource endowment, starting from its diversity of exploration up to provide stewardship for the SES (See Chapter 4). This implies that the governance system regulates the behaviour of all social actors irrespective of the ideological leanings or philosophical thinking in the SES (see Chapter 2). Thus, a key identifiable SESF variable intersecting the transformation of natural resource system value to social-economic outcome is the effectiveness of institutions evaluated on the basis of governance systems capability and enforcement of its operational rule. Although, there may be many factors that influence the effectiveness level of governance system design and

enforcement. However, analysing survey evidence from the human real-life experience in the SES influenced social perspective justifies the evidence linking the governance system and Nigeria's social-economic outcome. Evidence of natural resource condition influence on the social-economic outcome has been analysed using verbatim quotes from respondents. Moreover, natural resource value flow is evaluated from its social, ecological and economic contributions to its nearby households and communities, making the concept of sustainability thinking this this study fundamental. However, as an intersecting variable, this section explores direct evidence of governance system enforcement effectiveness level according to the ORN02 a local community chief in Ogoniland:

> *"The way they operated in other countries that should also be in Nigeria. For example, you are using a pipe of 50 millimetres in dimension, when you come to Nigeria you use 20 millimetres because government regulatory agencies wouldn't do anything. There should be standard, global standards. They should follow the best standard practice." (ORN02)*
>
> *"But I see that the government is not also sincere in effecting their actions. It is only been written on paper. Mostly to achieve this, these parastatals should be dragged down, let it be that anyway there is oil production, anywhere oil is going on there should be regulatory bodies in these areas to monitor the activities of these companies." (BBN02)*
>
> *"And because there are government agencies that are collaborators to the crimes. So, that is one way." BBN03*

On the question of instances, the government-enforced oil regulation to protect the local environmental resources, he replied that:

"I keep talking that it is the federal government that controls that, so we have not seen a tangible result to that effect." (BBN03)

Other respondents elaborated on this theme:

'So, another challenge is that about government will, in terms of implementation they don't know what they want too. A situation where you speak from one side of the mouth, and then you say another thing in the other side of the mouth. So double standards everywhere. So, there is no regulator who is willing to do the right thing. We also have regulators that are not sincere. Even the government are not sincere. So, insincerity on the part of operatives is another one. If you ask me too, I will say some of the regulations are not very clear." (OIE04)

"I won't give a plus to the government. From the operators to the regulators, there are compromises. And those compromises have led to environmental issues, litigations and all that." (OIE01)

"In recent times, it's been a case of NOSDRA, the government agencies still, not as effective as they should to put in the shortest form, because the so-called government agencies still in most cases depend on the oil and gas companies and the IOCs (International oil corporations) to even carry out their functions in the first place. … so, if you ask me, those agencies of government are only looking for how to extract their own benefits from the oil companies than any environment that involves them." (OIE03)

However, one of the expert witnesses, an HSE advisor to one of the oil multinationals, thinks otherwise, saying:

"Every day they be tightening the regulations, they keep reviewing them and making it better. But there is still a lot of coverage to be done in terms of manpower and

capability. But, there is also the Nigerian factor which involves backhand dealings between the IOCs and the powers-that-be, that weakens enforcement, it weakens the level of enforcement and you see some people going scot-free and getting their way with certain projects. But to be candid I think the regulatory bodies are improving they are reviewing their guidelines and they are becoming more stringent and more effective" (OIE02)

Another respondent, currently involved in the environmental clean-up of the Ogoni (ORN04) reported that:

"At some point, the Ogonis refused oil mining in their environment because of the harm being done and the government did not say no to them. They actually endorsed that made it possible for the community to achieve that aim of not mining oil in their environment. Hmmm, the government regulatory agencies, they try their best too. ...they come to the community (to) sensitise the community on how things are supposed to go, and how things would be afterwards." (ORN04)

From the evidence gathered so far, the broader perception suggests an ineffectiveness level of governance system enforcement. Nevertheless, the interview evidence also provides some survey respondents that suggest the governance system performance as average. However, survey evidence suggests the responsibility of governance systems in SES disruptions around oil mining fields. More so, the reported low governance capacity factors arising from poor funding, no work tools or outright abdication responsibilities suggest the reflection of governance systems structuring and in regulating the natural resource system. For example, an expert witness reported:

"Meanwhile it is in the budget. It is either somebody is seating on that budget and not releasing those funds or somebody has compromised those funds. So, I think on their

own part too they face a structural fundamental problem of funding which impede their ability to be there to regulate actually." (OIE01)

Besides this effectiveness level of governance system enforcement suggests the erosion of natural resource system value for sustenance and livelihood, as well as the social-economic outcome of the access and transforming these values. Thus, if the trade-off between non-renewable oil resource extraction that generates vast revenue and renewable natural resource systems with smaller but sustainable and broad-based distributive livelihoods are placed on a scale, then social-economic potential benefits/losses can appropriately be accessed. What this thematic analysis suggests is that, although the natural resources system configuration supports a diversity of natural resource units and values. However, the centralised governance system prioritisation of oil mining seems to suppress natural resource system value access to other social actors.

2. Basic Social Infrastructures Condition

The oil mining organisation contribute to the influx of skilled and non-skilled migrant workers into the different rural communities. However, interview evidence suggests that a number of the basic social infrastructures provided by the government are stretched beyond their existing capacity for the growing local population. Although this effect does not impose any known direct impact on the ecosystem condition. However, this study suggests a relationship between the intensity of oil mining activity that overstretches the perceived inadequately maintained basic social infrastructure imposes indirect social cost on households and communities. For example, the need to treat reported consequences of oil mining-related health complications, the overcrowded classrooms to meet the education needs of children in the community, and the stress on other social infrastructures such as land use for houses and road construction. A respondent, (ORN08) reported that:

"No water! There is no good road hospital, which is, no good medication within that environment. There is no water, there is no good road. In fact, there are some villages you cannot access except by boat. So, all those villages are neglected. There are no schools there in all those villages." (ORN08)

Likewise, a local women fish traders association leader reported that: *"Our women are dying young. Some of them (women) of about 40 years or 35years, their obituary will be announced."* (IAN06) The meaning of, "*their obituary will be announced"* is local metaphor for premature death experienced by some young women. Also, a biologist working as a monitoring and evaluation officer for a women's NGO reported that (ORN02) "*It was like total darkness. No hospital, no facility for the people, no scholarship, no impact so." (ORN02)* Additionally (IAN07), reported that the community women's group financed the construction the only secondary school in the local government area council. Yet, the women group were not allowed operate the school privately because the government authorities prevailed on them to handover the school to be managed for public good. She continues that:

"we have only one government secondary school in this environment, a whole LGA, which is not enough. Each of the classrooms has a population of 100 plus to 200 (pupils) and Junior Secondary class 1 is up to J to K, almost getting to Z." (ORN07)

Irrespective of the social perceptions from interview evidence, the question of balancing between investment in social infrastructure, safeguarding natural resource system condition and human wellbeing may experience variability in survey settings where oil mining consequences to the extent of governance system capability. Meanwhile, an oil expert witness (OIE02) reported that:

"Now, in terms of health facility that should help them to provide Medicare, you find out that it is lacking in a lot of areas. In terms of employment, you still have a wide gap

of those that are employable and those that are employed. And in terms of housing, you still have inadequate housing, in terms of rural infrastructure there is still a very wide gap, in terms or crime rate, crime rate is still very high. And you find there is a wide gap between products of these oil mining and the livelihood of these community." (OIE02)

Likewise, another expert witness employed by an oil multinational reported that:

"But again, if you look at it, the government in Nigeria tends to pay less attention to oil-producing communities than they do to others because they feel that if there is a company operating in your area you should get a share from the oil and gas operators in the area. That also keeps them, leaving the people at the mercy, the wings and caprices of the operators within the environment." (OIE03)

Exploring the evidence across the two categories of sample populations, the thematic analysis suggests an agreement on the failing social infrastructure. However, its direct social-economic impact on household income, communities' economic condition and national economy on the different societal segment has not been explored. But the interview evidence does suggest that the number of people depending on available infrastructure and natural resource system indirectly impact the social-economic systems.

6.3.3.3 Theme 3 - Social Effect

1. Cultural Heritage Destruction

There is the issue of social-cultural system connectedness to natural ecological systems based on people's attachment and the intrinsic value attributed to some of the derivable resource units in the survey setting. The configuration and uniqueness of some of the natural resource units attract patrons to social-cultural rituals, festivities, and ceremonies and reinforce their identity. In a particular instance, ORN02 reported; *"We also have stream*

they do some local swimming, local singing, and other social-cultural activities." (ORN02) Also, as experienced during the pilot interview phase by (OIE01) the people of and visitors to the Twon Brass Kingdom are not allowed to inflict any harm on Pythons because of their social-cultural belief system. Besides, BBN02 reported that *"Now our culture, as I said, we are fishermen... Part of our culture is that when somebody dies, we gather to commiserate with the people..." (BBN02)* Additionally, another survey respondent (ORN10) reported that:

> *"And then there are also some persons, who see the environment as a place where they carry out their worship. Some people worship the goddess of the river; they go there for inspiration; they go there to also gain spiritual power; beyond the spiritual inspiration they get, they get inspiration that can help them, like wood carvers, for instance" (ORN10).*

Despite the cultural sites and traditional religious worship by individuals and social groups who practice religious worship of deities associated with either the terrestrial, coastal, and marine ecosystems, there is forced social-cultural detachment and alienation of property rights once crude oil is discovered in the ecosystem according to provisions of the Petroleum Industry Act (2021). This hardly undocumented impact of colonial legacy that transferred property rights through institutional restructuring of divergent social-cultural ideologies, customary rights irrespective of the local social actors attributed value to the ecological system suggestively devalues the inestimable intrinsic value associated with geography (see Chapter Two). For example, ORN06 reported:

> *"There is one particular leaf used for cooking known as Okazi. The leaf was common in our forest. So, people go into the forest to harvest the leaves, even my family goes into the forest to harvest the leaves. Now, the issue is that the area has been devastated by spillage." (ORN06)*

Yet, the social-cultural satisfaction to natural resource system can be intrinsic, especially (IAN09) who quickly remind the researcher that "*I am proud of my land" and (IAN10) "I have never lived in anybody's community. I was born here in Mkpana community and I stay here in this community for my forty years of age"* suggestively reflect the evidence of social identity that may be inestimable monetary terms. Thus, social-cultural detachment from ancestral geography for oil mining based to comply with regulatory provision have unpredictable effects on social norms, values and belief systems that often underpin structures of informal institutions in local communities (see Chapter 2). Moreover, the extricability of social actors from their natural resource system without comprehensive social bargain suggest the untenability of the natural resources management that may merely perceive the ecosystem existence for resource extraction irrespective of the ecosystem functions and contribution sustainable development.

2. Social Perspective on Health Concerns

The long-term health complications of people living around oil spills and gas-flaring environments were widely reported across the many interview sessions. The data analysis result reveals cases of chronic diseases and mortality from oil spill incidents have been reported, even though other oil mining-related health complications remain undisclosed. In a particular instance, a community leader and retiree of an oil multinational (IAN04) reported that:

> *"You know, most of the women are having (birth) delivery problems now, most are under (surgical) operations. So, all these are health hazards because of what I have seen in all my years of experience since I returned. Our women are sick. In the whole of Akwa Ibom now, if you want to confirm medically, caesarean sessions are rampant here. Our women are complaining of miscarriage. I have told you the greatest cases of*

caesarean sessions now in Akwa Ibom state are in Ibeno, and most of our women are complaining of premature pregnancy termination." (IAN04)

Also, IAN09 reiterated that *"our drinking water is acidic because of the flare. You can't drink it; it is no longer a natural water. It is not good for the health" (IAN09).* Likewise, ORN07 reported that:

"Then apart from the oil spillage, the gas flaring is affecting the community seriously – our health, our skin, everything about us. Now it really affects us to the point that the people you saw like 2 – 3 years ago, you may not see them again because living very close to these gas flares and also inhaling those gas flare has affected our skin, our health condition, cancer and every other thing." (IAN07)

Before proceeding to review these evidences, another expert witness, reported that, *"So, you have a lot of health issues related to breathing and so on because of the pollution." (OIE05).* Likewise, a health, safety and environment advisor with 23 years field experience in an oil multinational provided his perspective as:

"But you discovered that these services are impacted due to occasional spills that can be as a result of process offset or engine, pipeline sabotage on the environment. That result to spill, and when the spills happened you discover that it affects the environment, apart from even affecting their livelihoods, it affects their health. I happened to visit a location for an environmental impact assessment study, people were complaining about asthma, they were complaining about certain disease that prevalent in the area which they attribute to oil and gas activities." (OIE06)

It is also important to consider the indirect impact of oil mining on health complications because of the diversity of migrant workers introduce to communities near oilfields. A respondent from Ogoniland reported that:

"As it is in my community, we have need had a case of sexually transmitted disease. It could be there before now, but the entrance and presence of new persons have led to a spike in increase, which is now an issue of discussion." (ORN01)

From another perspective, (ORN01) complained about another community concern of *"increase in child and also gender pregnancy. Increase in younger, younger female getting pregnant and delivery."* (ORN01). Meanwhile a female primary school teacher in Twon Brass Kingdom expressed her concern for young girls:

"I will still go back to issue like I said before, woman/man issue because for me, I have been saying it, Brass is still like Sodom and Gomorrah. That is how I look at it. You will see 13years old girl who is supposed to be under her parents, some of them will be the ones taking care of their parents, feeding them because they go about sleeping with men, collecting money and using it to take care of themselves and their parents" (BBN01).

Aside from the social issues emanating from migrant workers, another respondent reported that, "*our skin, everyone is complaining of skin rashes. They say the rashes are from oil pollution, different types of ailment"* (ORN08) and "*if you look at my body, heat rashes. We are suffering from environmental decadence"* (IAN04). However, there are no medical diagnosis linking reported incidence of health complications to oil mining were cite by these survey respondents. Irrespective of the subjectivity of these pieces of evidence, these reports represent real-life experiences in the survey setting that are verifiable by future studies. Moreover, these concerns related health complications will be evaluated more objectively in the survey questionnaire segment. Notwithstanding the subjectivities of the evidence, from data analysis results so far, the immediate intervention of regulatory authorities and oil mining companies remedy to oil spill events is the clean-up and remediation of spill sites or

payment of monetary compensation. The inability of any respondent to confirm the existence of medical outreaches for health complications diagnosis immediately after oil spills suggested consigning the responsibility on the social actors residing near oilfield to provide medical diagnostic reports to substantiate the claims to the linkages of their health complications to oil mining activities may be disingenuous. Moreover, for a survey context that is reported to be lacking enough healthcare facilities, that sourcing medical records or reports of hospital admittance and health data may be challenging. However, IAN04 did challenge the researcher, *"in the whole Akwa Ibom now, if you want to confirm medically, caesarean session is rampant here."* Besides, to corroborate the health concern claim in this study, scientifically proven evidence on specific health complications linkages the survey context can be verified from the UNEP (2011) on Ogoniland and Sentamu et al., (2023) on Bayelsa state, where Twon Brass Kingdom is located.

3. Mental Health Concerns

Another unexplored evidence in the survey setting is the linkage of social-ecological system disturbance to mental health concerns. listening iteratively to interview audio recordings, reviewing field notes, and the thematic analysis results provides traces of evidence of oil mining consequences in the natural resource system implicit linkages to social wellbeing. A survey evidence from an expert witness working with one of the oil multinationals linking the natural resource system to sustenance and livelihoods is reported as:

> *"There is a direct link between the what goes in the natural habitat in terms of oil and the incomes sources because the local habitats serve as the source of this crude oil. Now, the relationship between what is being mined and the product which is crude oil and other products that come from it, and their income sources is related and affect by these activities in a negative way because alongside the production of this crude oil*

and gas, comes a heavy toll of environmental pollution, all kinds of environmental pollution. And the level abatement, the level of containment of this pollution is low compared to the amount of pollution that is being experienced." (OIE02)

On a general note, the loss of people's sustenance and livelihoods from social-ecological system to avoidable oil mining externalities can contribute to incident of frustration. For example, exploring the evidence from reported perception during field survey, respondents that directly experienced oil mining impact on their ecological system expressed some emotions:

"there will be war ... helplessness and hopelessness" (IAN09),

"but I felt bad that we are going through this." (IAN09)

"government presence is not there! Nobody cares" (IAN10),

"everything is just dying", (ORN08

"one of my relative's child died from drinking that water. Nothing was done, no government official came, everything came back to status quo as if nothing never happened."(ORN07)

These identified evidences in response to the social-ecological system disturbance and alienation of property rights consequence suggest some level of helplessness and hopelessness, which could further studies can trace to linkages to the prevalence of conflictual situation and social agitations in this study. For example, (ORN04), one of the indigenes employed in the ongoing oil spill clean-up and remediation reported that:

"people are getting hungry. They no longer have farms to go to. They no longer have rivers to fish in. The river there has not dried up. But it is contaminated. They can no longer get fish. People that come to buy fish from far and wide no longer come to buy. So, it affects everybody. It affects everything." She continues with another piece of

evidence, "…everybody is hungry; everybody is angry." "A lot of people have actually gone into a lot of crime. Some of them have involved themselves in a lot of crime. People actually rob." (ORN04)

Unfortunately, aside from the direct health concern of the SES depletion, the loss of sustenance and livelihoods sources could also generate incidences of emotional responses that are not currently proven in this survey setting. However, some respondents who seem to have resigned to fate, when responding randomly to some survey questions tend to consign their social-ecological system disturbance from oil mining activities divine intervention. Below are evidences from the survey interview:

"They don't even want to do anything in the community, they leave us like that and we have no God to support us. We regret of their coming here, we regret of their stay, except, well, you there because of your write up, God will want the visit us upturn things and we will give thanks to God." (IAN04)

"I don't have anywhere that our children can go so that they can achieve one thing or the other. It is not easy, but we hope that God should come can see us through." (IAN06)

"That is only God that is coming to help the community." (IAN07)

These social actors' consignments of governance system actors' responsibilities addressed in the petroleum industry act (2021) to a divine intervention, suggest the reflection of their trust on the effectiveness level of governance system in providing any form of social, ecological and economic comfort. Besides, these social actors' inability to hold the oil mining and regulatory organisation accountable through the regulatory and judicial structures could also reflect their helplessness, resign to fate or mistrust in the system. Likewise, listening to the audio recording again, the choice of words spontaneously revealed to the survey questions

did not seem to be carefully rehearsed responses. Also, the alteration of tone pitch during the interview session also suggests attempts towards emphasising a point. In some instances, these evidence of survey actors' expressions of dissatisfaction towards their social-ecological system or economic condition suggest some of the intensity of grievances, which some community elders have speculated to contribute mostly to social agitations by youths. However, the lack of empirical understanding of the magnitudes of ecological system degradation that can translate into social-economic costs, health complications or even loss of lives represents some of the emotional burdens that is preliminary identified as an emerging concept in this study. Nevertheless, these arguments are suggestive rather than definitive based on the researcher subjective interpretation of the evidence.

4. Leadership Concern and Social-Ecological System Stewardship

There is another aspect of mistrust is the local community and political leadership representation with the oil regulation agencies and oil mining companies. A number of these leaders were reportedly acting in self-interest. For example, OIE04 an expert witness reported that:

> "*Some of our terrain like our local communities like Akaata, Atia, Ntemina, Okposo, all those places are destroyed and lost into the sea because of oil spillage and ocean surge. The locals have representatives. So, these representatives are not sincere, they are not very sincere. That is a challenge of the vast majority of local authority" (OIE04).*

Likewise, a local chief in Twon Brass Kingdom report that:

> "*So, when it comes to problems here, we have a leadership problem, which is caused by some of the multinational oil corporations because they are doing what is called divide and rule to destabilise the people. So, let me say we have a leadership problem." (BBN02)*

As for ORN04 from Ogoniland, when asked about her perception of how the community leader seeks solutions to local community problems, in response:

> *"She signs! That was a problem in itself. Most of the community leaders you see are not helping matters. Most of them are opportune to be educated and find themselves white collar jobs that pay, and their families actually live on it. And most of their families are not living in the vicinity. So, when you bring a problem to, they don't see it like it is affecting them directly." (ORN04)*

The type of situations has been reported to have aggravated social tension from the unhappy social actors who see them as sabotaging their collective well-being for personal interest. For example, in a particular community in Ogoniland, the process of appointing a leadership has been ongoing for about three decades sourcing that sometimes culminate into social agitations and security emergencies, necessitating armed security personnel intervention. For example, ORN07 reported that:

> *"For my own peculiar community, or lets many years that historical process was somehow lost. So, what happens now is the most, how do I put it… It is like a fight over who is influential. You see three or four people hustling and tussling to become the leader. Nobody wants the other person to lead, and it has been like this for over 30 years now. At least almost thirty years or more." (ORN07)*

Likewise, IAN03 reported that *"sometimes some of the community leaders are divided. Some people are very selfish. So, others are trying to sit together; others are trying to work for their selfish interests."* Also, ORN02 reported that *"it is just that people should respect the decisions of the leadership. But sometimes leadership tends to have an interest or bias mindset."*

From the collection of evidences, it can be suggested that the behaviour of community leadership who are supposed to serve and guide the social-ecological system interest of the

people have been below expectation. Yet, these leaders represent the traditional institutions, otherwise referred to as informal institutions provide traditional guidance and mediation of conflictual situations for social stability:

> *"And the whole community was angry; everybody came—men, women, children. Oh, these people have come again. They are coming to spoil our land again, they are coming to spoil our waterbody that we are beginning to manage again. They were making noise, carrying stones, sticks, and wanting to be violent." (ORN04)*

Where such leadership is lacking, the social tension of unhappy community elders and youths can degenerate into security emergencies that often require armed security the intervention of operatives. *Besides, an expert witness report that:*

> *You know once these oil and gas companies come into the community, they will always ask for the chiefs or opinion leaders within the community. And whatever they are going to provide for those communities will be through these people. But these elites at times you see them, the connive and then go away with these monies. (OIE06)*

Reviewing evidence from (ORN02, OIE06, ORN10) on local community leadership challenge deficit, beyond the effectiveness level of governance system capability and enforcement; there are other challenges associated with informal institutions undermining the social contract with their community over the activities of external social actors regulating or mining oil the social-ecological system.

The challenge with the leadership problem is either inability of informal traditional institutions to effectively moderate social behaviours or galvanise collective action groups to engage with external parties for social-ecological system safeguard. Meanwhile, a number of the survey evidence have also suggested the linkages of the insecurity and criminalities

challenges around peripherals that stretch leadership deficiency. For example, a female respondent narrating an incident reported that:

> *"In 2002, if I am not mistaken, 2002, 2003 I think I was writing my WAEC (West African Examination Council) examination then. There is this man they call Okpoloku, he is now our representative in Federal House of Assembly. Rt. Honourable Okpoloku. In 2002 when I contested, Ibeno all wanted late Honourable Ernest Okosho which happen to be very nice and honest man. Yes! And he was from Okoro precisely. So, the entire Ibeno wanted the man because he was honest. We knew him as an honest man. So, Okpoloku cam we said we don't want you. So been that he was from a royal family, the father was stupendously rich, you know their family was everywhere. I believe there is not country that Essiet family is not in. I think if there is I think it will be few. He said that he must, he must, he must represent Ibeno. I think he was contesting as a House of Assembly member. I mean House of Representative here in Akwa Ibom State. So, it was war, it was an issue between Ukpenekan and…, it was within Ukpenekan. They family that really kicked against it was Osoneyena. So Osoeyena people said he is not going to win the election. He is not going to represent the land that we don't want him. So, do you know what happen, there was war. They nearly killed Okpoloko. If you look at the man you will see one of his ears has been deformed because they burnt him seriously with a car. If not for God that intervene, they would have killed him. But after the war, they people that fought him are now are some of his boys. Yes! Because I have come to realised that he was blessed, he was ordained to represent the land. But along the line the man died, the Ernest of Okosho, though he won, he won the election. After some years, two to three years, he died. It was Okpoloku that completed his tenure and re-contested again." (IAN09)*

This IAN09 narration of political office representative tussle that underscore the unpredictability of community leadership and other security concerns. This suggest that responsibility of informal institution, as an important local community social stability enforcer complementing the authorised efforts of formal institutions empowered to regulate oil mining in the social-ecological system. Yet, when a respondent was asked the survey question on how community leaders seek solution to social problems*?"* A respondent reported that:

> *"From my experience, when it comes to leadership from my particular community, there is a really a bit of a problems because there is a tussle on who leads the community. So, nobody actually handles any problems. It is much like political (let's put it that way). Because of that tussle of leadership, problems don't really get that solved. There is not fixed way of handling it. Let say, a chief or an elderly person in the community, let say like the issue of security), could just reach out to someone in government and it is that person that will send security to come. Not necessarily the leaders in the community." (ORN07)*

To emphasise the community leadership challenge, ORN07 to another question reported by giving a case study:

> *"Let me give an example on still the issue of security, sometime in 2021 there was a clash and almost all members of the community ran away. It was the political leaders and some older people that reached out to the state government who sent security personnel to resolve the problem. After a month or two the whole security issue was resolved and people came back to the community."*

Although, the identified cases of conflictual situations related to social-ecological system was also corroborated by evidence from an expert witness:

"And of course, nonchalant attitude of some of the oil companies, believing that well we know you chiefs, we know your king, we have settled them, so, we can do what we want to do. So, they pollute the environment at will without considerations." (OIE01)

Finally, towards resolving the leadership challenges, IAN09 reported with these words:

"I am just praying that God should give us a good leader. The leader that would be sincere and honest, not people that are after their pocket. But the government has not been trying at all. Yes! Look at the community that is bringing out the wealth of the land, of this nation called Nigeria. But our leaders are not trying." (IAN09)

Although these evidences reflect the subjective social perception, it equally suggests the community leadership challenges with oversight on informal institutions that supplement the formal institution in providing stewardship for the social-ecological system. It is important to highlight that these corroborative evidences from interview surveys are gathered from different communities across three distinctive local government councils. Nevertheless, to concretise the interview evidence, survey questionnaire will be applied to complement results to make valid claims on the linkages of informal institutions oversight challenge to social-ecological system condition.

6.3.3.4 Theme 4 - Security Concern from Natural Resource System Extraction Consequences

An estimated twenty-nine million Nigerians live around the Niger Delta area (NBS, 2024), most of whom have community ties where they engage in different forms of farming, fishery and food processing, trading, paid employment in civil services, or oil industry and other informal small-scale occupations. However, from the interview evidence, the consequences of oil mining influence on social-economic outcome contribute to the conflictual situations based on the inability of the natural resource system within the survey

context to meet their expectation. More detailed evidence is provided by OIE06, oil multinational health, safety, and environmental advisor who narrated a personal experience:

> *"But I must tell you that personal greed is also intra and inter-communal conflicts you normally see in those areas. You see them they are always fighting among themselves, due to what they will benefit from oil and gas activities. Some will intentionally start claiming a location, the ownership of the land when it is not their own. When they know that there will be a lot of benefits, they will start claiming the ownership of your land that is not their own and before you know it they start killing themselves. They will start burning their houses all of a sudden. I had a terrible experience in those days when I used to be an Environmental Impact Assessment Inspector. I normally go to the field for environmental impact assessment activity. We were in a community, community A and by the time we finished and saw the next day we were coming to community B. By the time we got there the next day, the whole place had been deserted, all the whole houses had been burnt in a space of 12 hours. The whole houses have been razed down. What happened, it is a fighting, an individual more or less. It is an individual in community A and an individual in community B. At the end of the day, the other person killed the other person. Before you know it transformed into a communal war and houses are burnt. So, it is a volatile situation and what ignites it is due to benefits that are coming from oil and gas activities." (OIE06)*

Incidents of conflictual situations have been reported between social actors (that is, community stakeholders and oil mining organisations on the one hand, and community stakeholders and state actors on the other) because of the consequence of oil mining on the social-ecological system.

From another perspective, survey evidence suggests that although community leadership often seek to gatekeep community access, regulate social behaviour, norms, values and mediate accountability for natural resource system stewardship. However, the leadership capability and oversight has been identified to be experiencing its own self-interest challenge that made social-ecological system stewardship difficult. For example, in reporting a conflictual relationship with the oil companies, IAN09 stated:

> *"Our people have been murmuring that what we are supposed to gain, a group of people are trying to take it away, and oil and gas companies are not doing it."* (IAN09)

Meanwhile, according to IAN04, a local community leader and oil multinational retiree, when the committee of elders visited an oil multinational to present their grievances they *"were often met with humiliation."* (IAN04) Likewise, in another instance there was the refusal to engage with the community stakeholders by the government as responded to by (IAN09):

> "*There are two ways of solving issues – one through dialogue and the other through war. If you have applied the first measure, which is dialogue, understanding, and people putting their heads together, it doesn't work. Eeh! Then there will be war!" (IAN09)*

Another important piece of evidence from one of the respondents who reported that:

> *"Spillage was affecting the water, the fish, and the biodiversity, and no one was ready to help. And also, social corporate responsibility was not steady. And a lot of these were not in place. It was like total darkness. No hospital, no facility for the people, no scholarship, no impact. So, it affects the people. They were not able to resolve those issues when they were approached. I think that brought up the Ogoni Bill of Rights that was submitted to the Presidency, which led to the Ogoni crisis in the country because Ogoni has stopped them from operation." (ORN02)*

Furthermore, (IAN04) evidence conflictual relationship with oil multinational is reflected as:

> *"We relate with them; they are the people that have told you, even though we may want to discuss anything with them, they may attend to us. Sometimes they will give flimsy excuses for having the window for having such a discussion. And at any point in time, we see that the pressure is too much and we cannot withstand it; we go on protesting. They attempt to create a sort of troubleshooting of the crisis and manage it. I have told you earlier they spend their money to acquire military might—call the police, call military personnel to come and fight us. At all their gates they put formidable security barriers deterring us, the hosts, from having access to discuss with them. They put an elevating viewpoint for military personnel, military barracks to come and stay at the oil company's gate so that the citizens, the host may not have access." (IAN04)*

Unfortunately, the administrative offices of oil corporations and regulatory agencies, and the accommodation for their senior management are far removed from oilfields experiencing oil pollution may suggest the manner of their interaction with the social-ecological system. Nonetheless, the neglect to engaging community leadership on oil mining impact in the SES often contribute conflictual situations. For context, a community chief (BBN03) lamented that; *"rather than bring development, there bring underdevelopment as a result of crisis almost here and there because of the little crumbs that everybody wants to get from it."* Also, (ORN07) reported that:

> *"some people have lost lands, people have lost lands for farming. There is now reduced space for fishing which is people's mainstay of income. And it has forced a lot of people to go out (migrate) may to other local government areas, Port Harcourt." (ORN07)*

The broader outcome of these unresolved social actors' competitive interaction has exposed the SES to further devastation (ORN05, 0IE06). Therefore, violent agitations in various forms suggestively erupt against the governance system's perceived injustices in the survey setting. However, the perspective from OIE06 provides better clarity.

> *"They pirate that you may see around here, is because of no job(unemployment). No sentiment to, I told you initially, most of our boys will finish University of Uyo, University of Calabar or university, polytechnic or even monotechnic and come back home, stay at home for several years without any means of livelihood. So, can you imagine somebody doing project engineering, civil engineering and comeback home without any job? They will be lured into crime and criminality. So, if you even hear of pipe broken in Niger Delta, all those oil pirates and come what not, it is the same boys that are educated but no job for them that go into the creeks to make that particular action."* (IAN04).

Also, another community chief corroborates similar experience in Twon Brass Kingdom about 400 kilometres away from Ibeno:

> *"You find out that our children go to school and after graduation they want to go to higher institution, they will be thinking of how they will cross the river since there are other issues of accidents in the river, sea pirates in the river, except the government normally come once in a while to tackle things like that. All these are our problems, it is not telling well for the government." (BBN02)*

Additionally, an expertise witness with one of the oil multinationals corroborated previous evidence suggesting the linkages of challenges of insecurity to acts of survival:

> *"And if you alter the natural system of the environment that means you are invariably implying that the people whose livelihood is depend on that environment should look*

for an alternative. And if there is not alternative you are indirectly pushing them into either to survive with whatever means they can. This account for some of the social vices that are very common in the Niger Delta, where crime and criminality become a primary source of livelihood for the young people, for those who have the means. Someone once said that it is almost impossible for you not to depend on the crime economy of the Niger Delta because if they can't get fish, they can't farm because of poor quality of soil and all of that, where will they survive from. Kidnapping because attractive. Oil bunkering becomes attractive. All sorts of criminality become an alternative. Having systematically dislodge them from their primary source of livelihood." (OIE03)

Another aspect of insecurity in the SES is that of pure criminality manifesting as incidents of sea piracy, kidnapping for money, and crude oil theft identified in the survey setting, which was attributed to the issue of high youth unemployment. Also, there are other attempts in Ibeno by the sea pirates to steal speedboat outboard engines reported by a former youth president in Iwokpom community in Ibeno:

"Also, we are also experiencing, this was not there before, some bad elements who constitute sea pirates. They are not collecting some of our people who have money to buy outboard engines, they now stay somewhere around the river and collection our people's engines and stop our people from going into the sea. I told you we don't have government presence in our community. If we have, they will do something about it. Sea pirates are disturbing us here from going to sea. We need government to help to eradicate these people. Navy is everywhere, let them channel them to go into the sea and catch these people so that the sea will be okay for us to manage and go in to fish for the good of this state, for the good of this country." (IAN10)

A particular incident of sea pirates kidnapping for ransom was narrated:

> *"Pirate boarded FSO* (Floating Storage and Offloading Platform) *Yoho and carted away some guys. I wasn't on board because we were doing two weeks in, two weeks out. Before I even arrive Oso* (Oil Platform)*, pirates boarded Oso they looking for expatriates they did not find expatriates. Then they maliciously wounded the superintendent – what is known as the platform manager. All these are formation issues. Mayday issue." (IAN04)*

The recent violent killings in the survey settings were reported to be perpetrated by the supporters of a popular militant who was pacified with an award of oil pipeline surveillance contracts. The 'repentant' militant groups in executing their pipeline survey are provided with armed security officials to support their activities.

> *"So, if the ordinary villager sees that there is solution to his poverty state, running through a pipe that is crosses his backyard and then the possibility of tapping it and getting away just like every other person does, the temptation is high. As soon as they start tampering with the facility, the environment is polluted. Because they lack the necessary capability to control the activities within the environment. So, that is one – willing in policy implementation because they can't enforce laws. If you are weak in enforcing laws, they want to benefit from the illegalities within the environment, then policing become weak, those policing become useless." (OIE03)*

However, there have been accusations and counter-accusations of the diversion from their core mandates to different forms of criminal acts is damaging pipelines to steal crude oil for illegal refining or sale to ocean-going vessels. This below evidence was provided by an expert witness working in several communities near oil mining fields in the Niger Delta:

"The other day it was in the OML18 (Oil Mining Licence) took lots of days we all know what happen in the Nembe area two (an oil installation community near Twon Brass) involving a Nigeria oil company all that. So, if you ask me, those agencies of government are only looking for how to extract their own benefits from the oil companies than any environment that involves them." (OIE03)

From all the reported evidence, it is not difficult to differentiate between criminalities and social actors' genuine grievances against the devastation of the ecosystem. Whether the reported incidents are penetrated as acts of survival or criminalities, there are other social actors who invade their neighbours' farmlands to still food crops. For example, ORN03 reported that:

"Let's start with local theft, where people go to your farm to harvest your crop without your knowledge. You have a cassava farm, you have a yam farm, before maturity some set of criminals go harvest everything. That one alone is basic. That is one. Insecurity affects income in the community." (ORN03)

Also, ORN07 provided another evidence:

"Now for the fact, there are no people in the community, you find out that there is always stealing even these farms' produce we talked about, thieves visit other people's farms and steal this produce because nobody is in the community to check their farmlands".

Meanwhile, the conflictual situation and insecurity challenges, and its associated private and public costs could be suggested as a reflection the ineffectiveness of the governance system capability and enforcement the operational regulations for different of social-ecological system infractions, in delineating communities' boundaries, provide dispute resolution

mechanisms and protect lives and properties according to the constitution provision underpinning it. In an expert witness response:

> *"So, at the end of the day, even oil activities become very expensive because if you go to these companies together, there are heavy security organizations. You have a general manager security. Security now has become one big department, and it is eaten deeply on the budget of oil and gas activities on the Niger Delta." (OIE06)*

These expenses on security constitute direct and indirect private costs of oil mining that is borne by the oil corporation, but imposed the public costs of unpredictability on social-economic activities in the social-ecological system. As identified in the data analysis process, these sets of evidence suggest a social assessment of governance system capability and enforcement level on oil mining, social-ecological system stewardship and protection of lives and properties in communities near oilfields. The broader challenge is the impact of the effectiveness level of governance system capability and enforcement impede on sustenance and livelihood sources for other genuine social actors in the survey contexts.

Figure 14: A Visualisation of SES Variables Interaction Derived from Survey Evidence Coding

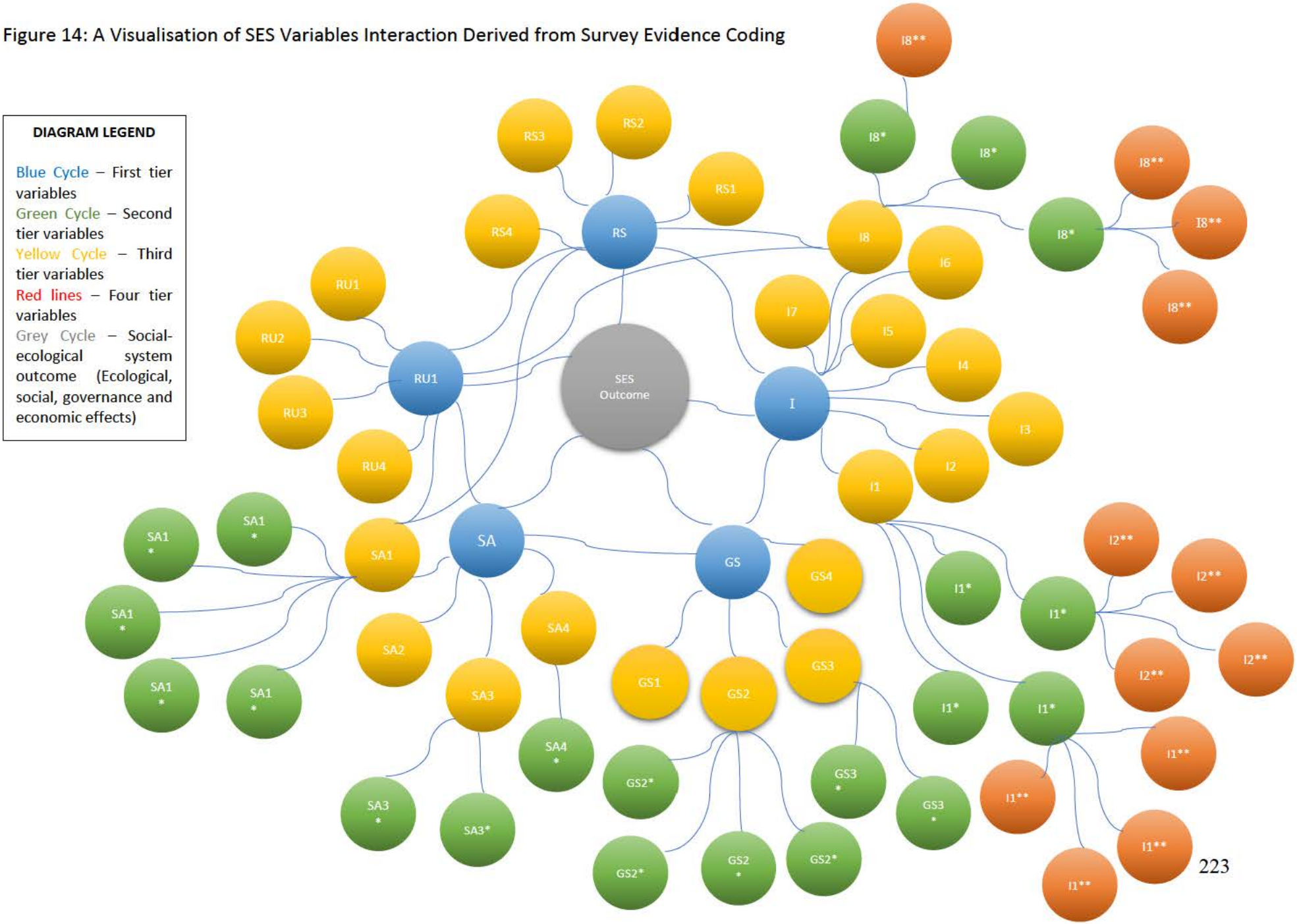


Table 9:The Modified SESF Variables for Survey Evidence Coding Interpreting Figure 14

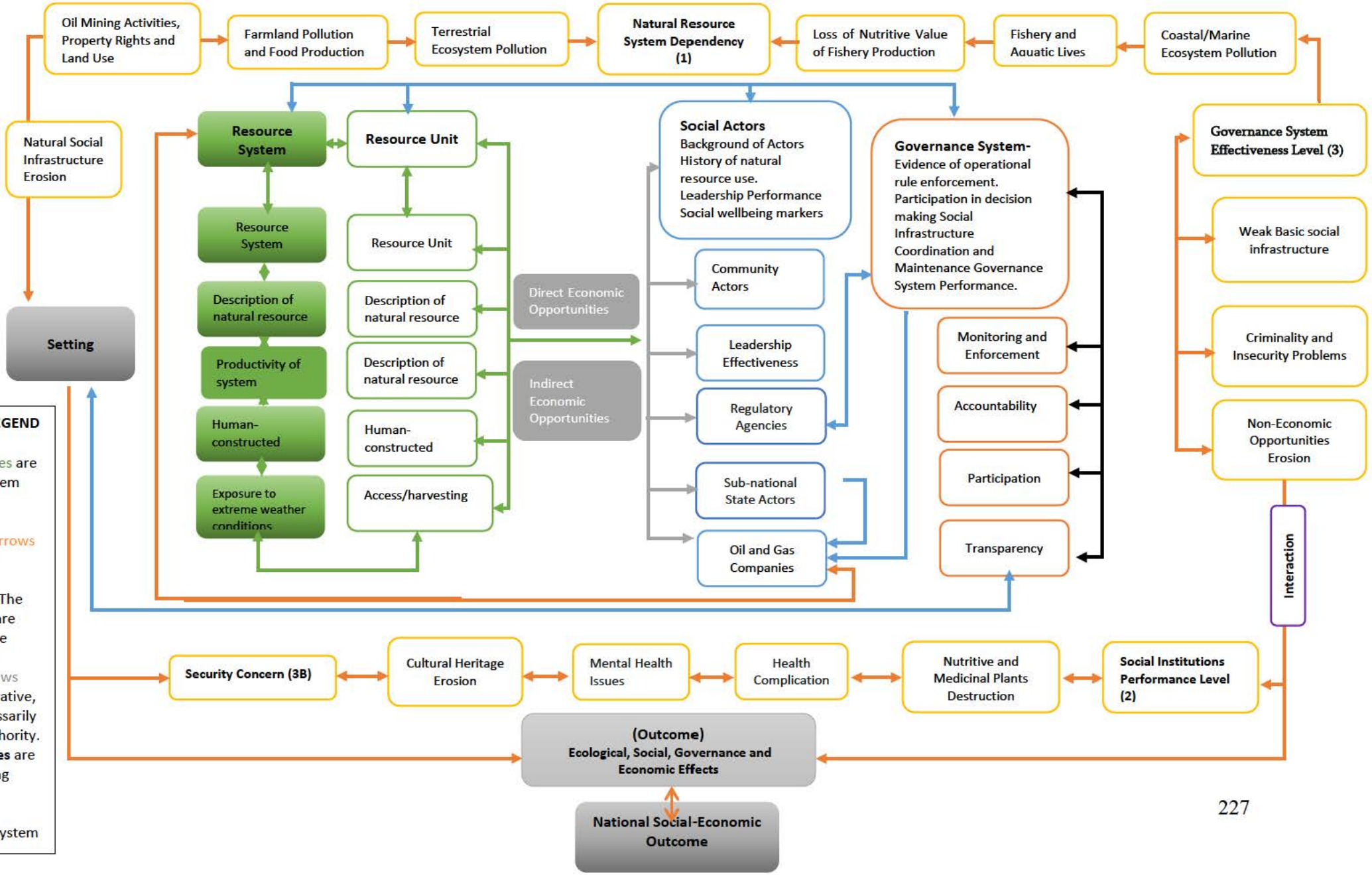
First-Tier Variables (McGinnis and Ostrom 2014)	Second-Tier Variables The researcher revised version of McGinnis and Ostrom's (2014) first-tier variables to capture survey evidence based on the specificity of study context	Third-Tier Variables First layer of emergent codes from thematic analysis from categorising survey evidence based the specificity of study context.	Fourth-Tier Variables Second layer of emergent codes from thematic analysis from categorising survey evidence based the specificity of study context.
Setting	Social-Political Social-Economic		
Resource System (RS)	RS1*-Description of natural resource system assets. RS2*- Productivity of system RS3*- Human-constructed facilities RS4* Exposure of resource system to extreme weather conditions		
Resource Unit (RU)	RU1*- Distinctive characteristics of Resource Units. RU2*- Productivity and Economic Potentials. RU3*- Access to resource units harvesting RU4*-Ratio of dependence on resource system/units		
Interaction (I)	I1* - Access to resource units harvesting. I2* - Available economic/ non-economic opportunities. I3* – Cordiality I4* - Conflictual Situations. I5*- Resource System and Oil Fields Interface I6*- Competition	I2**Direct Economic Opportunities I2**Economic Opportunities Erosion I2**Indirect Economic Opportunity I2**Non-Economic Opportunities Erosion I5**Gas Flaring I5**Natural Recreation Facility I5**Air Pollution I5**Oil Spill	I2***Fishery and Aquatic Lives Destruction I2***Insecurity I2***Soil Productivity Loss I2***Unemployment I2***Weak Basic Social Infrastructure I2***Non-Economic Opportunities I2***Cultural Attachments I2***Mental Health Issues

			I2***Natural Aesthetics and Recreational Benefits I2***Health Complications I5***Fresh Drinking Water I5***Coastal and Marine Ecosystem I5***Soil Fertility
Social Actors (SA)	A1* – Background of Actors A2* - History of natural resource use. A3* - Social wellbeing markers. A4* - Leadership Performance	A1**Community Actors A1**Oil and Gas Companies A1**Sub-national State Actors A1**Regulatory Agencies Others A3**Social Wellbeing Marker Disruption A4**Leadership Effectiveness and Weakness	
Governance System (GS)	GS1* - Evidence of operational rule enforcement. GS2*- Participation in decision making. GS3*- Social Infrastructure Coordination and Maintenance GS4* - Governance System Performance.	GS1**Accountability and Transparency GS1**Monitoring and Enforcement GS2**Participation GS3**Regulatory Failures GS4**Regulatory Enforcement and Accountability	
Outcome (O)	O1* – Ecological Effects Q2*- Social Effects O3*- Governance System Effects O4* - Economic Effects	O1**Quantity and Quality of Natural Resource Units O2**Social Institutions Performance Level O3**Governance System Effectiveness Level O4** Household Income, Community Level Economic Condition, and National Outcome	

6.4: Empirical Usefulness of Thematic Visualisation and Interpretations of Findings (Figure 14) and (Table 9)

Table 9 interprets the visualisation based on the researcher mapping of the relationship deductively and inductively derived for survey evidence coding through Nvivo software in the qualitative data analysis segment. The second column (Green) are the first layer of emergent codes for categorising survey evidence from the survey context. These emergent codes which indicates the outcome of the SES interaction in the oil mining context beyond the foundational SESF variables, necessitated the deeper exploration to identify into subsystems (third-tier variables) and sub-subsystems (fourth-tier variables) as information to capture and categorise survey evidence based on the specificity of the interaction in the survey setting. Additionally, the codes were selected according to relevance and consensus to some ideas identified in survey evidence. For comparison of the deductive codes proposed in the code dictionary in Appendices 3 and the emergent code inductively identified from the coding exercise is reflected in Appendices 11. As an improvement on social-ecological system framework mapping in Table 1 (see Chapter 4) and proposed in Table 5 (see Chapter 5), the deductive and inductive codes developed and mapped in this data analysis (Figure 14 and outlined in Table 9) is a reference list of variables for the characterisation and exploring the pattern of interaction within the survey setting. Although, this data analysis results provides a multilevel and scale nested framework outlining the variables and dimensions of interactions in the survey setting, including the identified structural relationships supported with visual representation (see Figure 13), this result only represents introductory identification variables for systematic field survey and complex ecosystem evaluation. Expectedly future studies with further refinement can apply the tables and figures for tracking field survey evidence when examining social-ecological system problems around oilfields.

Figure 15: Illustration of Social Perception on First, Second and Third SESF Variables Mapping's Linkages to Emergent Themes



6.5: Interpretation of Figure 16 Illustrating the linkages of First, Second and Third Variables Mapping to the Emergent Themes In this Study

Figure 15, is designed to bring more clarity of the survey evidence linkage to the data analysis and themes as visualised in the Figure 14 (interpreted in Table 9). For explanatory purpose, the green two-way arrow represents the resource (RS) and resource unit (RU) interaction with the social actors (SA), serving as the sustenance, livelihood and entrepreneurial linkages through direct and indirect economic opportunities. The grey two-way arrows represent the multiple levels of interaction between the contextual social actors (SA) irrespective of their power ratios. The blue arrow represents the two-way governance system monitoring and enforcement interaction, particularly with the RS and RU, but partially two-way with SA because of the provision for the feedback mechanism. However, oil mining regulations is represented by the one-way arrow interaction between the governance system and oil and gas companies. The black two-way arrow represents the interaction between the elements underpinning the governance system capability. The orange two-way arrow illustrates the interaction between the emergent themes and sub-themes suggesting the performance of the governance system, the social-ecological system condition and the social-economic outcome in line with the Objective 7. Accordingly, the identified SES outcome effects (ecological, social, governance system, and economic) interacting at different levels and scales to define the sustenance and livelihood sources and its overflows from the individual, households, communities, and sub-national governments up to the national economic levels is the basis for interpreting the qualitative research findings in Table 11. If the visualization is well-understood, it suggests unbalanced representation and interaction social actors which is acknowledged as a key factor for determining SES stewardship and social-economic outcome.

Table 10: A Summary of Social Actor's Classification and Dependency Level for Data Coding Exercise in the Survey Setting.

Social Actors (SA)	Resource Units (Units)	(Interaction) Activity	Ratio of Dependency	Resource System (RS) Description	Attributed Values to the Natural Resource System / Outcome (Ecological, Social, Governance and Economic) Effects
Primary Stakeholders (Local fishers, farmers, trader, women, youth and leaders)	Terrestrial Ecosystem for sense of place, habitat, farming, wood, sand medicinal plants, recreation, and fresh air). Coastal and Marine Ecosystem for drinking water, fishes, seas foods, woods, cultural attachment, nutrition, medicinal plants, coastal and marine transport and cultural attachment	Fishing Farming Trading Lumbering Artisan Services Cultural Practices Recreational Activities	High	Terrestrial Ecosystem Coastal and Marine Ecosystem. Natural Recreational Services	Accommodation - sand Drilling and lumbering for building materials Lumbering for firewood Accommodation Food Production System Nutritional security Medicinal Plants, Entrepreneurship Sustainability, Employment, Livelihoods Social Infrastructure Conflictual Situation Traditional Knowledge Social rules Cultural diversity
Migrant Fishers	Livelihoods, sea foods, livelihoods	Labour Fishing Food production	(High to Medium) Relative to Resource System Quality		
Tourists	Recreational facilities (Fresh air, beaches, aesthetical beauty), fishes and sea foods, local delicacies, artisanal crafts	Enjoying the Landscape for therapeutic healing	(Low) Relative to Resource System Quality		Stretching of natural resource threshold Employments, Livelihoods
Migrant Fisher Traders	Fresh and dried fishes, sea foods	Trading	(Medium to Low) Relative to Resource System Quality		Employment Livelihoods Accommodation

Oil Mining Companies and Operational Servicing Vendors	Terrestrial, Coastal and Marine Ecosystem for accommodation Extract hydrocarbon resources through drilling for processing, storage and supply. Humanly constructed facilities to serve corporate goals. food crops, fishes, seas foods, recreation, drinking water and coastal and marine transportation	Drilling Construction Production, storage and distribution facilities	High (Relative to Resource System availability and job opportunities)		Oil pollution Gas flaring Overstretching of basic social infrastructures Deforestation Entrepreneurship Royalties Taxes Employment Social Infrastructure Markets Scientific Knowledge Technical know-how Corporate social responsibility
Migrant Workers	Habitat, food crops, drinking water, fishes, seas foods, woods, fresh air, recreation, coastal and marine transport and Salary	Paid Employment and consultancy			Overstretching of basic social infrastructures Transmittable diseases Technical know-how Taxes Markets
Day Labour/ Artisanal Labourer	Terrestrial, Coastal and Marine Ecosystem for accommodation, food crops, fishes, seas foods, recreation, drinking water and coastal and marine transportation	Labour and specialised services			Entrepreneurship Taxes Markets Specialised Labour
Oil Regulatory Agencies	Design and enforcement of operational rule for resource use and allocation. Accommodation, food crops, fishes, seas foods, recreation, drinking water, coastal and marine transportation	Regulation and enforcement oversight. Policy advisory, Social actors' reconciliation	High		Domination of other property rights Weak Effectiveness Level of oil mining management. Security Challenge low maintenance of basic social infrastructures

6.6: Interpretation of Table 10 Summarising the Data Analyis Coding of Survey Evidence of Social Actor's Classification and Dependency in the Survey Context.

To reinforce the qualitative data analysis, result visualised in Figures, 13, 14 and 15 and tabulated in Table 9, Table 10 reveal each social actor's attributed values to the natural resource system in the SES from the interview evidence coding exercise. Also, this table reveal the pattern of social actors' interaction either for sustenance and livelihood, industrial mining for resources and revenue that support household's income, micro-community economic and national economic conditions. For clarity, the governance system regulating these interactions and underpinning the specificity of results generated from thematic analysis is a set of different laws and operational guidelines but dominated by a centralised Petroleum Industry Act (2021), followed by the Land Use Act (1978) and Customary Rights in the hierarchy of the constitution in place in the survey setting (see Chapter 3). Accordingly, it is the consequences of these social actors' interactions with the social-ecological system based on the power ratio of each different social actors (depending on the constitutional authority) that influence the social-economic outcome identified in this study. By capturing the diversity of natural resource benefits from ecological system services to determine the social-economic outcome, this study result mirroring a diversity of valuable results on different levels and scales in the survey setting suggest the broad ecosystem provisioning, regulating, supporting and cultural identity services extracted across the network of social actors. This knowledge could strengthen capacity of empirical science and policy actors to respond extend systemic thinking in complex social-ecological system interactions, foster sustainability sciences through deeper conceptualisation and broader operationalisation of the social-ecological system framework. This discovered pattern as illustrated in Figures 13, 14 and 115 and outlined in Tables 9 and 10, underpins the depth of qualitative analysis.

Figure 16: Illustration of Themes and Sub-Themes Linkages to SESF Outcome Effects in the Survey Setting

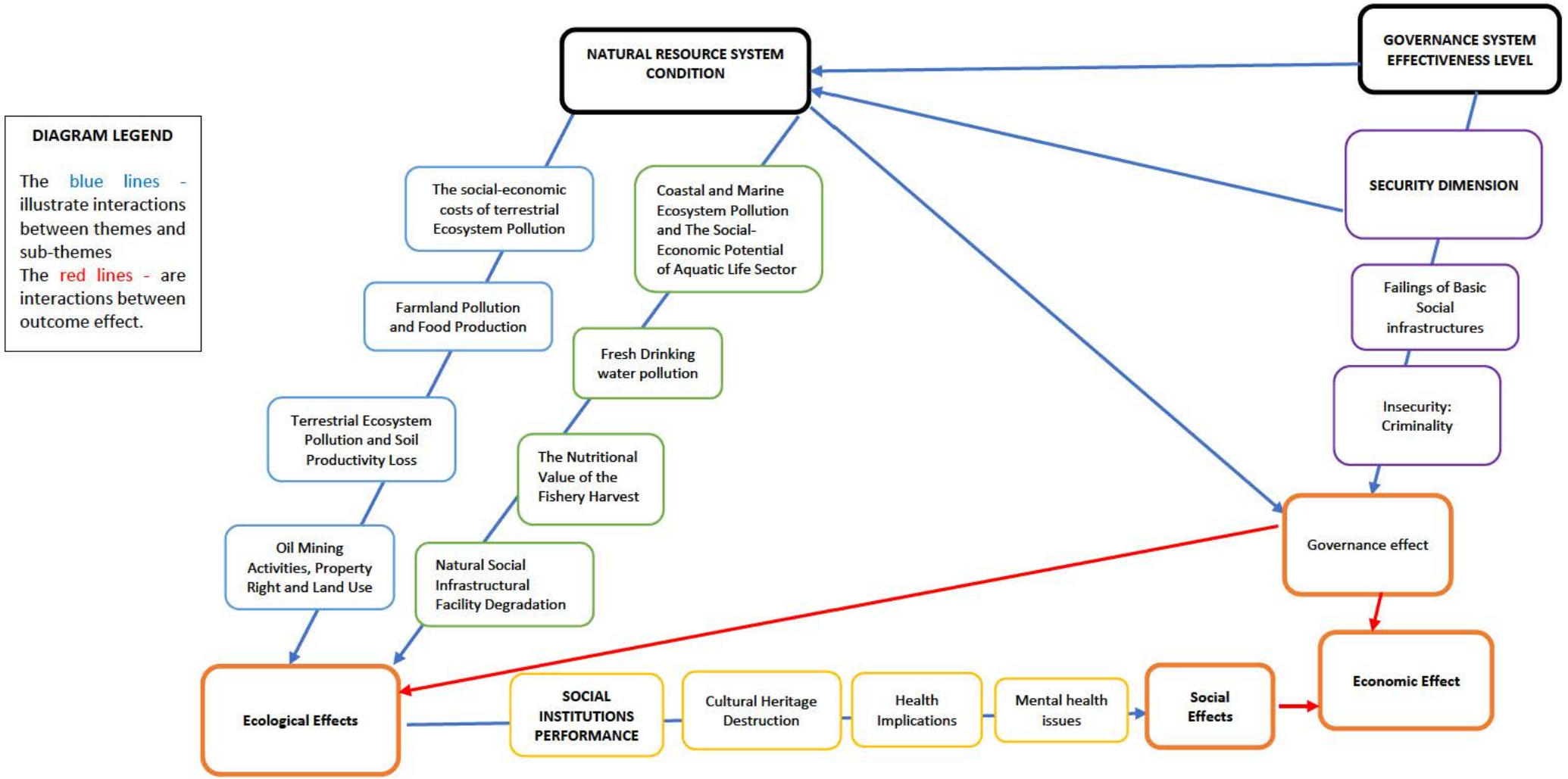


Figure 16 visualises the interactions of outcome effects (illustrated in Figures 14 and 15) and the factors influencing each effect from oil mining consequences based on the perception of experiences by social actors in the SES around oilfields surveyed.

Table 11:Outcome Effects of SESF Variables Interaction From Field Survey Evidence

Research Objectives	Outcome (Effects) Variables from Data Analysis	Sub-Themes for Explaining Outcome Categorisation	Themes	Summary of Findings
Building on research Objectives 2, 3 and 4, to design and apply a purposive mixed-methods diagnostic framework for collecting three layers of field survey evidence that connects the research problems with research findings.	Ecological Effect	<u>Ecological System</u> 1. Quantity and quality of food crops, fishery, livestock harvests. 2. Energy crops, including fuelwood and charcoal wood. 3. Available plant species for indigenous medicines. 4. Size and quality of wetlands and coastal ecosystems 5. Key geographical features. 6. Potentials of food, aquatic life, rare and species of plant. 7. Availability of markets for resource units harvest.	Natural Resource System Condition	• Despite the biodiversity of the natural resource system, consequences of oil mining reportedly suppress its productivity as social actors' sustenance and livelihoods sources. • Data analysis results from this study suggest a linkage between oil mining externalities in form of oil spillage and gas flaring impact the social-ecological system with broader threat to the quality and quantity of farm crops, fishery products and fresh water harvests in communities near oilfields. • A noticeable dilemma from the qualitative thematic analysis result is that oil mining activities transfer their private costs through externalities to the social-ecological system with disproportionately impact on indigenous and resident social actors.
	Social Effect	<u>Social Performance</u> 1. Ratio of Dependency on natural resource system. 2. Level of trust in community leaderships. 3. Level of participation in decision making. 4. Level of trust in political leaderships.	Social Institutions Performance Level	• Aside from sustenance and livelihood sources, other attributable values to the natural resource system is based on its habitat, intrinsic, traditional worship, recreational, transportation, medicinal and nutritional values to indigenous social actors. • Beyond the challenge of the effectiveness level of governance system enforcement, the local social actors' mistrust for their community leadership based on the perceived belief of their self-interest

		5. Incidents of social agitations and conflict Resolution Mechanisms. 6. Level of Stakeholders' accountability. 7. Incident of Abnormal Behaviours. 8. Number and persistency of cultural celebrations.		pursuit suggest the unpredictability of informal institutions. • There is a perception of health complications and security concern from the consequence of oil mining on indigenous and resident social actors.
	Governance System Effect	<u>Governance System</u> 1. Governance system Transparency and Accountability. 2. Impact of operational rule on resource systems. 3. Access to education, healthcare, fresh drinking water, motorable roads and housing. 4. Security status of communities around oil mining communities.	Governance System Effectiveness Level	• The inability to identify, explore and standardise the values attributed to natural resource system, its extraction process and the stewardship for SES safeguard suggest a lack of governance system perceptiveness of the value of non-oil resource potential in the survey setting. • The unpredictable nature of informal institutions administering customary rights in the SES, and their influence on natural resource extraction, contributes to trade-offs, suppression of sustenance and livelihood source which contributes to conflictual situations. This challenge is compounded by the governance system authorised by the federal law to regulate oil mining activities. • The inability to hold oil corporations to fully account for their oil mining externalities by the governance system with converging sets of laws, suggest that the centralised natural resource management approach subordinates the land use act and customary rights from safeguarding the SES in the survey context.

				• The wide perception of the unreliable basic social infrastructure condition, despite the influx of migrant workers to the rural communities for oil mining activities suggest the perceptiveness of the governance system capabilities and effectiveness in the survey setting.
			Security Condition	• This study provides evidence of unpredictability of oil mining externalities that is randomly offloaded on the SES, imposing a public cost that contributes to conflictual interactions in the survey setting. • Qualitative thematic results suggest that the inability of the governance system to enforce the applicable sanctions for regulatory infractions on the social-ecological systems when the oil companies contravene the oil mining operational laws influences conflictual issues and security concerns that disproportionately affects other social actors' ability to source sustenance and livelihood.
To understand the relationships between oil mining activities and other natural resource system values around the oil mining context for explaining Nigeria's social-economic problem	Economic Effects	<u>Social-Economic System</u> 1. Designation of resource units as livelihoods sources. 2. Income from harvested resource units. 3. Employment benefits from oil mining. 4. Transaction cost around oil mining communities.		• There is a perception that the revenue from oil mining activities threatening other natural resource system values may only generate short-term revenue flow to the national economy, as against the long-term consequences on the social-ecological system sustainability. • Qualitative thematic analysis results provide evidence of the relationship between natural resource configuration, food cultivation, fishery,

		5. Economic contribution of oil mining to proximal communities. 6. Livelihood generation from fishing, farming, forest formation and tourism around Context. 7. Human development indices such as educational level, employment rate, health indices, Income level, poverty ratio.		food processing and livelihoods sources and employment. • This study suggests that the practice of treating oil mining consequences on social-ecological systems along with the associated outcome as externalities inadvertently underestimates the deep implicit social costs on sustenance and livelihood sources and suggests governance system imperceptiveness. • The social actors participating in this study perceive that the first causalities of natural resource system breakdown are individuals and households whose sustenance and livelihood are sourced directly or indirectly from the natural resource system productivity. • The study provides evidence of a perception that the applying penalties, taxes, subsidies and payments of compensation as a form of regulatory control of oil mining externalities does not fully capture the explicit and implicit public costs imposed on the social-ecological system. This research suggests that the existing policy incentivises mining social actors to believe that there is a price tag for SES depletion.

6.7: Interpretation of Thematic Analysis Illustrating the Linkages of Themes and Sub-Themes to the Study Outcome Effects in Figure 17

This table 11 illustrates the outcome of the multiple levels and scales of interactions between the different social actors in the SES based on the network of attributable values to the natural resource system from qualitative data analysis. For clarity, the data analysis is the result of the categorising of survey evidence in the coding process through Nvivo using the deductively designed codes (see Appendix 3), and inductively discovered codes to generate themes (see Tables 9; Figures 15, 16 and 17 and Appendices 11). These research findings interpreted from themes, reveal the pattern and qualitative outcome effects interconnecting the research objectives with the mapped SESF outcome variables and survey evidence. This themes and sub-themes from the thematic analysis will provide insight designing the survey questionnaire and statistical analysis in Chapter 7. This study has provided the opportunity to evaluate the multifunctionality of social-ecological system around oilfield beyond oil mining activities in terms of ecosystem services. This is an important contribution to the literature on the other dimensions of social-ecological systems contribution to natural resource-dependent economies outcome, on which very few known studies have explored.

6.8 Chapter Summary

This chapter presents qualitative results from the first and second-phase survey interviews related to Objectives 5, 6, and 7. The SESF was adopted for its structured approach and comprehensive coverage of social and ecological dimensions, facilitating variable testing in specific contexts. This study employed a diagnostic SES framework, slightly modified to incorporate mixed methods, case-based, and rule-based reasoning (Cox 2011). It aimed to identify interaction patterns across SESs and integrate ecological thinking into social perceptions regarding natural resources. The framework was refined by unpacking core SESF variables into subsystems and integrating ecological concepts, with second-tier variables derived from relevant literature based on geographical and resource-specific uniqueness. Each variable was analysed for its ecological, social, governance, and economic outcomes. The selection of analysis units influenced the study's practical considerations. Qualitative analysis focused on coding community perceptions from survey interviews, employing both deductive and inductive approaches to develop a model of interaction patterns within the SES. New ecological attributes influencing social-ecological interactions were mapped interactions using survey evidence and illustrates the analysis with figures and tables to show the linkages of emergent themes, derived from the SESF framework. Key themes include resource system condition, governance system effectiveness, social performance, and security, with subthemes generating foundational findings to be further analysed quantitatively.

The analysis indicates that the governance system's ineffective level in managing oil mining externalities leads to significant social, ecological, and economic costs, adversely affecting household income and community economics. Additionally, the undervaluation of non-oil natural resources threatens food production and security, impacting employment,

food inflation, and poverty across regions through trade. These findings reflect the interplay of formal and informal institutions, shaped by social norms, values, ideologies and oil industry regulations. Despite the identified competing laws, property rights conflicts, and governance system capability, findings that reflect the survey context's impact on national economic outcomes may only represent a starting point to a broader problem. Nevertheless, this analytical SES framework integrating social, economic, and ecological dimensions into SES theory suggest that relying on the foundational SES framework as the common analytical structures for exploring the multiple dimensions and components of social-ecological system across contexts might be unrealistic. The modified SES framework serves as a foundation for future interdisciplinary research, enabling exploration of social norms and property rights in relation to ecological disturbances

CHAPTER 7

RESULTS AND ANALYSIS OF THE QUANTITATIVE DATA

7.1 Introduction

This chapter presents the results from the analysis of quantitative data to complement the qualitative data in response to Research Objective 7 to "conduct a quantitative analysis of survey questionnaire evidence to generate results and findings for meeting Objective 6, as a preliminary understanding of the research problem." This chapter quantitative analyses starts with descriptive statistics of the field survey evidence. Then, the data analysis proceeds to apply Pearson Chi-Square, and Spearman correlation evaluation to identify for statistical association and significance between the selected categorical field survey evidence. Selected descriptive analysis results are hypothesised for inferential statistical evaluation to valid generalisable claims on the research arguments. The results are presented in tabulated format and interpreted to generate findings that are applied to complement and corroborate findings from the qualitative findings in the previous chapter.

7.2 Exploring Human Real-Life Experiences in SES Around the Niger Delta Oil Mining Context

The chapter explores survey questionnaire evidence from the interaction within the SES around the oil mining context to determine its influence on the social-economic systems. The whole idea of analysing evidence of social perception based on practical human experiences in the oil mining context is to evaluate the linkages of the natural resource system values and to sustenance and livelihoods at the household level, the community's economic condition, and its overflow to the national economic outcome. Thus, this study categorises the result based on its effects on the four key SES variables, such as the ecological (resource system and resource units), social, and governance and economic system. The study applied statistical

significance for the categorical data to be collected at a 95% confidence level with a 5% error, generating a justified sample size of 384 (Krejcie and Morgan, 1970). This systematic approach of generating a representative sample size of 384 suggests the generalisability of the statistical results and findings when making inference about a larger population. Nevertheless, these results and findings should be considered within the context of its limitations because the survey relied on sample populations with specific real-life experiences in social-ecological system around oilfields. For example, the thematic analysis finding suggests that the centralised governance system bias towards oil mining at the detriment of other natural resource system values with competing property rights. Nevertheless, before developing hypothesis statistical analysis, the evidence representing the mapped SES variables was assess for its suitability for statistical analysis. The analysis starts with the descriptive statistics before proceeding to the inferential statistical relationship in the second segment.

7.3 Analysis and Interpretation of Descriptive Statistics

The descriptive statistics illustrate the social-economic outcome variables using ecological system, social, and governance system effects of human interaction in the SES under study. This segment presents the demographic profile of the survey respondents starting from the location where evidence was gathered (see Table 13), gender distribution survey respondents (see Table 14), the proportion of survey respondents with real-life experience in ecological systems around oilfields (see Table 15), and perceptions of the main sources of income (sustenance and livelihoods sources) (see Table 16).

Table 12: Locations for Administering Survey Questionnaires

Location	Population (n)	Percentage (%)
Akwa Ibom	30	7.4
Bayelsa	72	17.7
Cross River	52	12.8
Delta	55	13.6
Edo	13	3.2
Rivers	81	20.0
Lagos	55	13.6
Abuja	28	6.9
Respondents that choose not to pick locations.	10	2.5
Invalid responses without location	10	2.5
Total	406	100

Whereas the survey plans targeted populations from the selected locations, the target number of the survey respondents in some locations (Akwa Ibom, Edo, and Abuja) were not achieved. Sample population targets from other locations (such as Bayelsa, Cross Rivers, Lagos, and Rivers) exceeded their estimated sample populations. A total of 1,453 respondents visited the survey questionnaire online site, out of this figure, only n=406 survey responses were received from the n=384 responses expected. But a population of n=395 fully completed all the questions in the survey. However, 10 survey respondents that did not select any location could have influenced the inability to extract the spread of the evidence across the locations that could not meet the estimated population. Also, while 8 questionnaires were completely blank with no answers, 2 respondents partially completed the questionnaire. Thus, at an average response population of n=392, this non-response to the survey questionnaire did not influence the success of the field survey exercise (please see Tables 13 to 16). The reasons for the non-response could not be ascertained because the survey was distributed randomly and anonymised with no ID or contact information of the survey respondents. Nevertheless, this study followed precautionary measures to ensure that the survey questions were simple, specific to the selected indicators, and had alternative

responses, including “not sure” and “no answer,” for ease of participation. Besides, because the questionnaire was administered remotely, other factors such as electricity power availability, technology efficiency, access to smartphones and computers, or money for data subscription were considered by providing an ample timeline for participation. The survey link was shared across many private online networks and in the public domain, and data support of 100 megabytes was provided to respondents that reached out via telephone the phone number provided. One of the cues from the field survey exercise unlike survey interview that requires stakeholder’s engagement and trust building, quantitative method applying remote survey technique depend on the respondent’s discretion to participate the survey exercise, which poses unpredictability to data collection within the timeframe.

The Distribution of Survey Respondents’ Gender in the Survey Questionnaire.

7.3.1 Missing Data

Generally, missing values (non-response) were identified in the dataset from some survey respondents who failed or are unable to answer questions the questionnaire (see Table 13). Thus, this missing evidence from the field survey can impact the accuracy of the evidence analysed for generating results. Accurate data imply data completeness since incomplete data can weakening the statistical strength of the data analysis result. However, Bengtsson and Lindblad (2020, p. 6) recommend the ‘Listwise Deletion’ for dealing with missing values. This deletion technique deletes all the observations with missing values on any variable. Thus, since the missing data are randomly spread on the survey evidence across locations, the deleted data are unlikely to generate unbiased results for analysis. For example, among the n=406 survey respondents, n=9 identified missing values where the respondents did not complete up to a minimum of 15 survey questions. Only 3 survey respondents fell into this category, while the remaining 7 respondents did not complete the question beyond

completing their location and gender. So, based on the 'Listwise Deletion' approach, the missing values in the survey questionnaire have been eliminated from the dataset. Thus, a maximum 396 survey response are expected as against the minimum calculated sample size of 387 in the different categories of the analyses.

Table 13 Proportion of Survey Respondents with Practical Experience of Oil Mining Context

Options	Visited SES	Percentage (%)
Yes	297	73.2
No	72	17.7
Not Sure	23	5.7
No Options Selected	14	3.4
Total	406	100

In response to the highlighted research Objective 7 in the chapter introduction, this descriptive data analysis segment reveals the linkages between data analysis results (themes 1, 2 and 3 covering natural resource system condition, social effect and governance system effectiveness in the qualitative analysis) with the evidence from survey questionnaire before proceeding to test the statistical relationship (see Tables 9, 10 and 11). For example, about 73.3% of the survey respondents indicated to have visited communities around oilfields in line with the pragmatist's standpoint adopt in the research strategy. Although the survey questionnaire did not specify if the experiences are repetitive, unlike semi-structured evidence where the sampled population were considered on specific criteria on up to 5 to 10 years residency in the survey setting. However, options of "no", "not sure" and "no answer," as selected by 17.7%, 5.7% and 3.4% of the respondents respectively, suggest the percentage

of the evidence that is not likely to represent real-life practical experience of the SES is minimal. Nevertheless, survey evidence aimed for a higher percentage of respondents with real-life practical experiences. However, some respondents might have misunderstood the terminology of communities with oilfields because of the lack of knowledge that over 5000 kilometres of pipelines interconnecting different oilfields and terminal across the length and breadth of the Niger Delta area (NNPC, 2015).

7.3.2 Gender Balancing of Survey Respondents

Attempts were made to provide equal opportunities for all genders in the sampled population by administering the questionnaire randomly. However, the achievement of male to female respondents of about 63% to 37% may not have been quite successful despite the attempt. Nevertheless, aside from the eliminated non-complete responses, 3 respondents did not complete their gender on the survey questionnaire.

Table 14: Gender Distribution of Survey Respondents

Gender	Evidence	Percentage (%)
Male	246	62.3
Female	147	37.2
Not Specified	2	0.5
Total	395	100

Table 15 presents evidence on gender distribution, considering that the female gender constitutes 49.95% against the males constituted 50.05% in Nigeria (NBS, 2024). Also, the participation of 3.2% in Edo, 7.3% in Akwa Ibom State, and 6.9% from Abuja, all less than the targeted participation during the field survey exercise, could have influenced the inability to

gather gender-balanced evidence. However, the evidence from the female perspective provides preliminary insights into the research phenomenon, which future studies can explore.

7.3.3 Ecological Effects

The survey questionnaire collected field evidence on perception of local populations of the relationship between oil mining consequences and the condition of the SES, comprising terrestrial, coastal, and marine ecosystems, and the multiple levels and scale of the social-economic system, such as household income, community economic condition, and national economic outcome. It considers selected indicators for accessing the attributed values to natural resource units in the survey setting. Based on the indicators applied in collecting the field survey to discover theme 1, the evidence from the survey questionnaire is analysed (see Figure 18).

Table 15: Description of Natural Resource System from Survey Evidence

Options	Responses	Percentage
Healthy natural environment	22	4.6%
Fertile Land, diverse farm produce and medicinal plants	54	11.4%
Large bodies of water, diverse fishes and other sea foods	165	34.9%
Tropical Rainforest and mangrove forest	78	16.5%
All of the Above	117	24.8%
Others	36	7.6%

The description of the SES in Table 15 suggests a combination of natural environment (4.6%), fertile land, diverse farm produce and medicinal plants (11.4%), large bodies of water, diverse fish and other sea foods (35%), tropical rainforest and mangrove forest (16.5%), all of the

above 24.8%, and others (7.6%) based on the survey evidence. This evidence reveals the configuration of the natural resource system (RS), the available natural resource units (RS), and the attributable value by some social actors that generate their sustenance and livelihood needs. However, natural resources from which the oil and gas mining are extracted and transformed were deliberately omitted from the option so that the survey respondents do not express bias against it because the industrial scale of extraction in the survey setting.

Table 16: Perception of Income Sources Around Oil Mining Communities

S/N	Options	Responses	Percentage
1	Paid Employment	75	10.2%
2	Informal Artisan Service	70	9.5%
3	Farming	156	21.2%
4	Fishing	247	34.5%
5	Trading	113	15.4%
6	Day Labour	75	10.2%

From Table 16, the survey evidence reveals the total population of 55.7% is grossly dependent on natural resource system value in the SES, divided into 21.2% farmers and 34.5% fishers in the SES. Out of this populations, trading attracts 15.4% and day labour at 10.2%. The first impression from this evidence in Figure 18, suggest that the configuration of the natural resource system and access may be influencing the occupational choice of local social actors (see Table 16). Also, this evidence is important because a cumulative percentage of 70.7% of respondents that indicated fishing, farming, and trading suggests the ratio of the population dependent on the natural resource system suggest that a high population are likely to be self-employed or serving as employers deriving sustenance and livelihoods from the natural resource system. Likewise, this evidence also suggest that a larger percentage of the social actor may prefer social-ecological system safeguard to support their sustenance and

livelihood needs. The broader impact of the evidence suggests that sustenance and livelihood sources from the natural resource system is interlinked with other social-economic activities and social wellbeing activities in the survey setting. Thus, any negative consequence from oil mining on the social-ecological system could be problematic for household income and community economic condition, especially for the coastal and marine ecosystem that influence the faster mobility across wider geography broader implications on food production system, food supply and availability, employment for vulnerable groups especially women and youth which can in combination contribute to food poverty.

Figure 17: Tabulation of Descriptive Survey Evidence Analysis

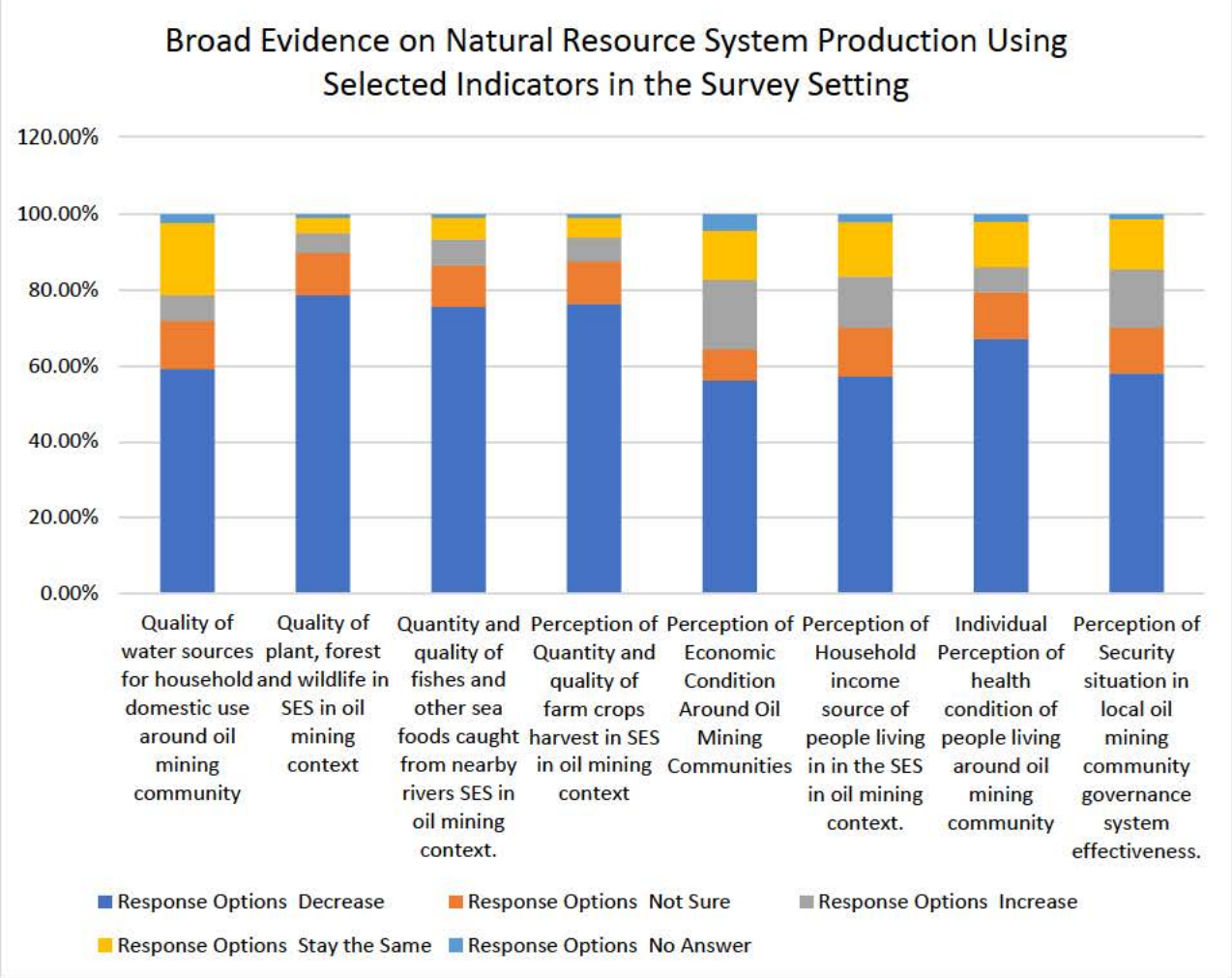


Figure 17 presents broad evidence on the SES condition based on the selected indicators for assessing the productivity of the natural resource system in the survey setting.

Although evidence on the reported randomness of the consequences of oil mining has been qualitatively evaluated in Chapter 6, this evidence does reveal that the consequences of oil mining may not be solely responsible for the condition. For example, aside from 47.7% of respondents indicated 'all of the above', 7.9% of respondents indicated that the loss of land to ocean surge and encroachment as the most difficult problems in the survey setting (see Table 18). Nonetheless, the natural resource units supporting the food production system using selected proxy indicators, such as quality of water sources for household domestic use and plant, forest, and wildlife; and quantity and quality of fish and other sea foods and farm crops harvested in the survey setting, have been reported to be decreasing, as selected by 59.14%, 78.7%, 75.6%, and 76.3% of respondents respectively (see Figure 18). However, if this complementary evidence is integrated into Table 18 for analysis is considered, the result of 55.7% of the population engaging in fishing and farming with SES with depreciating natural resource units corroborates the impact of disrupting sustenance and livelihood sources with broader implications on household income, the food production system, food scarcity, food inflation, unemployment, and even food poverty.

This evidence of a decrease in household income because of environmental degradation and an increase in poverty and unemployment from lack of economic opportunities as the most difficult problem faced by the people living around the survey setting was also corroborated by 10.9% and 15.5% of respondents respectively (see Table 18). Yet, 47.7% of respondents selected 'all of the above' to represent a higher percentage experiencing this same decrease in income, increased poverty and unemployment in the survey setting. The implications of the dataset suggest a governance system enforcement that prioritised oil mining activities inadvertently suppresses the natural resource system value flow to households, communities and other social-economics system outside the survey

contexts. Besides, with 67.2% of respondents indicating a decrease in the local health condition in a SES context where 62.3% reported that the basic social infrastructures are in a bad condition, suggest that the challenge of health complications poses an additional cost burden on household income who might need to travel a distance or seek private services to treat ailments. Nevertheless, aside from this analysis from descriptive statistics, the result of the association between ecological effects and household income level and the economic condition of the community is evaluated in the segment statistical analysis.

7.3.2 Social Effect

The leadership of collective action when engaging other actors in SES stewardship in the survey setting is represented by three main roles head of communities based on inherited by traditional lineage, clans or family, nominated individuals to leadership position in social groups, or elected representatives to political offices as identified from survey interview evidence. The different groups collaborate either as units or sub-units to regulate social interactions, especially for natural system extraction stewardship in the survey setting (see Chapter 6). However, over two-thirds of respondents indicated that the local community leaders, (71.9%) and political representatives (72.5%) were pursuing their own interests (see Table 17). Also, 55.1% reported that the relationship between the oil industry regulatory agencies and community people is 'not cordial and 57.1% similar with oil mining corporations (see Table 19). This result suggests the strength of the informal institutions represented by local community leadership on one hand, and on the other the perception that the non-cordial relationship in the survey setting is capable of contributing to the problem of security concern that is reported to have deteriorated by 58% of the respondents as against 15.5% that perceived that the security situation had improved or 12% reported that they were not sure in reporting the security condition (see Figure 18). Considering the percentage of the

social-actors dependent on the natural resource system, where local community leadership because of their self-interest pursuit, are unable to engage with other institutional social actors in the oil industry then the people in the bid for survival can resort to self-help approach. The unpredictability of the self-help approach can influence the conflictual situation, security concern and instigate the community youths into abnormal behaviours as suggested by qualitative data analysis results.

Table 17:Perception of Local Communities Leadership Performance

Options	From your experience, what do you think of the manner in which the local community leaders interreact with government agencies and oil companies to seek solutions for difficult community problems? (Question 15)		From your experience, what do you think of the manner in which the local political representatives interreact with government agencies and oil companies to seek solutions for difficult community problems? (Question 16)	
Options	Responses	Percentage%	Responses	Percentage%
They represent the people's concerns	51	13.0%	35	8.9%
They are fighting for their own interests	282	71.9%	284	72.5%
They are concern about government interests	18	4.5%	19	4.8%
They are concerned about the oil companies' interest	11	2.8%	26	6.6%
Not Sure	30	7.6%	28	7.1%

Table 18:Perception of the Most Difficult Problem Around Surveyed Oil Mining Context

Options	Responses	Percentage %
Loss of land to ocean surge and encroachment	28	7.1%
Lack of basic social infrastructure	41	10.4%
Local community leadership challenge	27	6.8%
Increase in poverty and underemployment from lack of economic opportunities	61	15.5%
Decrease in local resident income because of environmental degradation	43	10.9%
All of the above	188	47.7%
None of the Above	6	1.5%

Table 19: Perception of Relationships Between Social Actors in Survey Setting

Description	Response Options (%)			
	Cordial	Not Cordial	Do not Know	No Answer
Relationship between oil industry regulatory agencies and the community people	68	224	72	28
	13.5%	55.1%	22.7%	8.6%
Relationship between oil mining corporations and the community people	53	216	89	34
	17.4%	57.1%	18.4%	7.1%

7.2.3 Governance System Effectiveness Level

From the results in Table 20, a total of 76% of the survey respondents indicated that the governance system enforcement and SES monitoring system are “not effective,” as against 12.2% that report it is as effective. Also, the basic social amenities and public infrastructure are reported to be in bad shape by 62.3%, as against 8.7% of the survey respondents that indicated that they are in a good state (see Table 22). Likewise, from the respondents the perception ownership of source of water for household use is either by community self-help (44.2%) or individual efforts (30%) (see Table 21). Besides, when the community experiences the consequences of oil mining, 36% reported no form of support is received; 9.6% reported that the government provided support; 12.4% indicated that private individuals provided support; and 19% indicated that oil organisations provide support (see Table 20). However, 22.8% of the survey respondents were “not sure” of any form of support (see Table 23). Additionally, on the most difficult problem faced in the SES in the oil mining context, 47.7% of the survey respondents reported they were experiencing multiple problems, 15.5% reported to be experiencing underemployment from lack of economic opportunities, and 10.9% indicated they experienced a decrease in income because of

environmental degradation (see Table 23). This evidence suggests the effectiveness level of the governance system capability and enforcement for natural resource management and the SES stewardship and all the natural resource value to it below social-economic expectation of the people.

Additionally, considering the inability of some social actors to access their sustenance and livelihood sources from SES at the household level, this could have a broader impact on the entrepreneurial development, food production system, food scarcity, unemployment, and food poverty at the community level and other context dependent on it (see Figure 17). The suggested economic impacts could be exacerbated by the reported condition of basic social infrastructures that support rural social-economic activities for households and the community. Besides, the inability of government agencies to provide palliatives to the people for the difficulties from the consequences in the oil mining context on ecosystem which the governance system is unable to suggests the vulnerability of the food production, rural population, employment and the other sustenance and livelihood sources. Consequently, the dominancy of the centralised governance system over the competing Land Use law and customary rights in the SES around oilfields suggest the suppression of other natural resource system values along with the associated social-economic potential which survey evidence has indicated overflow to household income and micro-community economic condition.

Table 20:Perception of Effectiveness Level of Governance System Enforcement

Question 19	Response Options (%)			
	Not Effective	Effective	Do Not Know	No Answer
In your experience, what do you think about the manner in which the oil industry regulatory agencies enforce regulations to protect the local natural environment?	300	48	33	12
	76.0%	12.2%	8.4%	3.1%

Table 21:Perception of Sources of Water Ownership for Household Consumption

Question 4	Response Options (%)				
	Local Community	Individuals	Government	Not Sure	No Answer
Who owns the domestic source used by households around the local community?	175	117	39	50	15
	44.2%	29.6%	9.9%	12.6%	3.8%

Table 22:Perception of Basic Social Amenities and Public Social Infrastructures Around OilMining Context

Question 13	Response Options (%)				
	In Bad State	Ongoing Rehabilitation	In Good State	Not Available at all	Not Answer
What do you think about the condition of basic social amenities and public infrastructure such as roads, schools, and health centres around oil mining communities?	224	66	34	25	23
	62.3%	16.8%	8.7%	6.4%	5.9%

Table 23: Perception of Human Experiences from the Consequences Oil Mining on Ecological System Crisis

Options	Responses	Percentage%
Government agencies provide palliatives	38	9.6%
There was no form of support	142	36.0%
Private individuals provide support	49	12.4%
Oil mining companies provided palliatives	75	19.0%
Not Sure	90	22.8%

Table 24:Perception of How Oil Industry Regulators Can Reduce Difficult Communities Problems

Options	Responses	Percentage%
More emphasis on enforcing existing regulations	186	47.5%
Not Sure	13	3.1%
Improve their capacity	85	21.7%
Design new regulations	93	23.7%
Not Answer	15	3.8%

7.2.3 Social-Economic Outcome

Evidence from the ecological, social and governance system effects has been analysed to understand the economic effects of social actors' interactions in the SES. This represent social actors' access, extraction and transformation of the natural resource system for sustenance and livelihood in the survey setting.

Table 25:Relationship Between Oil Mining Consequences on Ecological System Opportunities and Social Wellbeing Contribution to Nigeria's Economic Problems

Question 22	Response Options (%)		
	No	I do not know	Yes
Do you think that oil mining consequences on SES economic opportunities and social wellbeing around the Niger Delta contribute to the Nigeria's economic problems?	65	57	269
	16.6%	14.5%	68.8%

The evidence in Figure 17 reveals that 57.2% of respondents indicated the household income sources of people living in the survey setting are decreasing as opposed to 13.6% that reported that they are increasing. Likewise, 56.2% reported that the economic condition around oil mining communities has decreased against 18.5% that reported that it increased. Besides from Table 25, the evidence reveals that 68.8% as against 16.6% of the survey respondents indicated that the consequences of mining on the SES economic opportunities and social wellbeing in the communities have broader implications on the Nigerian social-economic problems. This result suggests the approach to natural resource management and the consequence of oil mining impact on sustenance and livelihood sources from the natural resource system social-ecological system around oilfields which threatens the food production system, food scarcity and inflation, unemployment, and food poverty, also overflow to national social-economic systems. Thus, from the survey evidence, the linkages between the household income, economic condition in communities near oilfields can be

trace to the national economic outcome. While this analysis with descriptive statistics complement thematic analysis result from the qualitative chapter, the data analysis proceeds to test for statistical association of selected descriptive results using Pearson Chi-Square and the strength of the association using Spearman Correlation.

7.3 Inferential Statistical Evaluation: Pearson Chi Square and Spearman Correlation

The inferential statistical analysis test for statistical association and correlations. The indicators considered for this analysis are the separate linkage of the health concern, security concern, the effectiveness of governance system linkage to household income level and local economic condition of the community in the survey setting by generating hypotheses for the test. All Pearson Chi-Square and Spearman correlation statistical tests are performed using SPSS version 23. This purpose of supporting the Chi Square test with the Spearman Correlation is to evaluate then an association between the variables are identified, to further test for the significant in order to corroborate, confirm or refute data analysis result with the inferential statistical analysis. With a significant association, the research findings are valid and generalisable to other contexts

$$\underline{\chi c^2 = \sum Ei\ (Oi - Ei)^2}$$

$$Ei$$

Where

- c is degree of freedom
- O is Observed frequency
- E is Expected frequency

rs = 1 – (6 * Σd^2) / (n * (n^2 – 1))

Where:

1. rs is the Spearman correlation coefficient.

2. d is the difference between the ranks of corresponding variables.
3. n is the number of pairs of observations.

7.3.1 Hypothesis for Statistical Evaluation

Following the qualitative data analysis result and the complementary descriptive data analysis suggesting the outcome effect, a list of variables underpinning the core research arguments have been hypothesised for the purpose statistical analysis.

1. Evaluation of the perception on relationship between individual health conditions and household income sources of people in the survey setting.

Null Hypothesis (H_o): There is no significant relationship between individual health conditions and household income sources of people living in communities near oilfields.

Alternative Hypothesis (H_1): There is a significant relationship between individual health conditions and household income sources of people living in communities near oilfields.

2. Evaluation of the perception on relationship between security conditions and household income sources of people in the survey setting.

Null Hypothesis (H_o): There is no significant relationship between security conditions and household income sources of people living in communities near oilfields.

Alternative Hypothesis (H_1): There is a significant relationship between security conditions and household income sources of people living in communities near oilfields.

3. Evaluation on the perception for relationship between the efficiency level of the oil industry governance system influence on social-ecological system condition around the survey setting.

Null Hypothesis (H_o): The efficiency level of the oil industry governance system capability and enforcement does not significantly contribute to perceptions that the consequences of oil mining on local environmental resources in the survey setting.

Alternative Hypothesis (H_1): The efficiency level of the oil industry governance system significantly contributes to perceptions that the consequences of oil mining on local environmental resources in the survey setting.

4. Evaluation of the perception on the relationship between household income sources and the economic condition in communities near oilfields.

Null Hypothesis (H_o): There is no significant relationship between the household income sources and the economic condition in communities near oilfields.

Alternative Hypothesis (H_1): There is a significant relationship between the household income sources and the economic condition in communities near oilfields.

5. evaluation for relationship between economic condition in communities near oilfields and the perception that oil mining contribute to Nigeria's economic problems.

Null Hypothesis (H_o): There is no significant relationship between the economic condition in communities near oilfields and the perception that oil mining contribute to Nigeria's economic problems.

Alternative Hypothesis (H_1): There is a significant relationship between the economic condition in communities near oilfields and the perception that oil mining contribute to Nigeria's economic problems.

7.3.2 First Segment of Analysis

At the first level, the analysis evaluates perception of the statistical association and significance between the SES condition and survey evidence on the perception of individual health concern of the people (Question 11 in Appendix 2), security concern (Question 12 in Appendix 2), and each of their relationship with the perception of effects on household income (Question 10 in Appendix 2). The purpose of these analysis is to identify the

relationship between the effectiveness of governance system on household income in order to complement and statistically support the result in Tables 19 and 22 evidence in Figure 17.

7.3.2.1 Evaluation of the relations between the perception of individual health conditions of people living in communities near oilfields and household's income sources of people in the same context.

Table 26: Statistical Analysis and Crosstabulation of Evidence on Individual Health Concern and Household Income (Chi-Square Tests)

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	52.593[a]	9	<.001
Likelihood Ratio	50.589	9	<.001
Linear-by-Linear Association	13.901	1	<.001
N of Valid Cases	388		

a. 3 cells (18.8%) have expected count less than 5. The minimum expected count is 3.55.

Table 27: Statistical Analysis and Crosstabulation of Evidence on Evidence on Individual Health Concern and Household Income (Symmetric Measures)

		Value	Asymptotic Standard Error[a]	Approximate T[b]	Approximate Significance
Ordinal by Ordinal	Spearman Correlation	.166	.059	3.316	.001[c]
N of Valid Cases		388			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

c. Based on normal approximation.

Interpretation of Results

1. **Chi-Square Tests Results:**
    - **Pearson Chi-Square Value:** 52.593, df = 9, $p < 0.001$
    - **Likelihood Ratio:** 50.589, df = 9, $p < 0.001$
    - **Linear-by-Linear Association:** 13.901, df = 1, $p < 0.001$

The p-values from the Pearson Chi-Square, Likelihood Ratio, and Linear-by-Linear Association tests are all less than 0.05, indicating a statistically significant association between individual health conditions and household income sources among people living around oil mining communities. This suggests that the perceived changes in individual health conditions are related to the sources of household income in these communities.

2. **Symmetric Measures:**
    - **Spearman Correlation:** 0.166, $p < 0.001$

The interpretation of this analysis is that Spearman Correlation value is positive and statistically significant, indicating a weak to moderate positive relationship between individual health conditions and household income sources. This implies that variation in health conditions is related to changes in household income sources in the context of oil mining communities. However, this relationship between health conditions and household income can be possibly due to varying access to healthcare and resources among different income groups.

7.3.2.2 Evaluation of the perception of the security conditions and household income sources of people living communities near oilfields.

Table 28: Statistical Analysis and Crosstabulation of Evidence on Security Condition and Household Income (Chi-Square Tests)

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	92.847[a]	9	<.001
Likelihood Ratio	82.372	9	<.001
Linear-by-Linear Association	33.695	1	<.001
N of Valid Cases	388		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 6.97.

Table 29: Statistical Analysis and Crosstabulation of Evidence on Security Condition and Household Income (Symmetric Measures)

		Value	Asymptotic Standard Error[a]	Approximate T[b]	Approximate Significance
Ordinal by Ordinal	Spearman Correlation	.316	.055	6.546	<.001[c]
N of Valid Cases		388			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

c. Based on normal approximation.

Interpretation of Results

1. **Chi-Square Tests Results:**
    - **Pearson Chi-Square Value:** 92.847, df = 9, $p < 0.001$
    - **Likelihood Ratio:** 82.372, df = 9, $p < 0.001$
    - **Linear-by-Linear Association:** 33.695, df = 1, $p < 0.001$

The p-values from the Pearson Chi-Square, Likelihood Ratio, and Linear-by-Linear Association tests are all less than 0.05, indicating a statistically significant association between the security situation and household income sources of people living in communities near oilfields. This suggests that changes in the security situation are related to variations in household income sources in these communities.

2. **Symmetric Measures:**
    - **Spearman Correlation:** 0.316, $p < 0.001$

The interpretation of this analysis is that Spearman Correlation value is positive and statistically significant, indicating a relationship between the security situation and household income sources. This implies that perception of variation in security conditions is moderately

related to changes in household income sources in the survey context, potentially reflecting how experiences with security influences perceptions of economic status.

7.3.3 Second Segment of Analysis

This segment of analysis tests the statistical association and significance between the identified variables (perception of regulatory capability and enforcement effectiveness, household income level and micro-community condition) contribute to Nigeria's economic problems. This implies that the analysis cross-tabulates (Questions 19 and 22, Questions 9 and 22, and Questions 10 and 22 in Appendix2 and visualised in Figure 17) to test for the statistical association between the economic condition at the micro-community level and the social-economic problems at the national level. As supplementary, an analysis is conducted to tests the respondents' perception of household income sources and the economic condition of the oil mining communities where the people source sustenance and livelihoods (see Questions 10 and 9 in Appendix 2). The purpose of these analyses is to identify the relationship of the effectiveness of governance system capability and enforcement on economic effects, as well as household income level and micro-community economic condition on national social-economic outcome in order to complement and statistically support the suggested relationships in descriptive statistics and qualitative data analysis result.

7.3.3.1 Evaluation of the relationship between the perception of the oil industry regulatory of regulations of social-ecological system around oilfields, and the consequences of oil mining on natural resource systems on Nigeria's economic problems.

Table 30: Statistical Analysis and Crosstabulation of Evidence on Oil Industry Agencies Enforcement, Natural Resource Impact on Economic Opportunities and Nigeria's Social-Economic Outcome (Chi-Square Tests)

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	15.008[a]	4	.005
Likelihood Ratio	13.482	4	.009
Linear-by-Linear Association	.008	1	.929
N of Valid Cases	390		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 6.58.

Table 31: Statistical Analysis and Crosstabulation of Evidence on Oil Industry Agencies Enforcement, Natural Resource Impact on Economic Opportunities and Nigeria's Social-Economic Outcome (Symmetric Measures)

		Value	Asymptotic Standard Error[a]	Approximate T[b]	Approximate Significance
Ordinal by Ordinal	Spearman Correlation	-.027	.058	-.542	.588[c]
N of Valid Cases		390			

a. Not assuming the null hypothesis.
b. Using the asymptotic standard error assuming the null hypothesis.

c. Based on normal approximation.

Interpretation of Results

1. **Chi-Square Tests Results:**
    - **Pearson Chi-Square Value:** 15.008, df = 4, p=0.005
    - **Likelihood Ratio:** 13.482, df = 4, p=0.009
    - **Linear-by-Linear Association:** 0.008, df = 1, p=0.929

The Pearson Chi-Square and Likelihood Ratio tests show p-values less than 0.05, indicating a statistically significant association between the manner in which oil industry regulatory

agencies enforce regulations and the belief that oil mining contribute to Nigeria's economic problems.

The Linear-by-Linear Association p-value (0.929) is well above the conventional significance level of 0.05, suggesting no significant linear relationship between the variables.

2. **Symmetric Measures:**
    - **Spearman Correlation:** -0.027, p=0.588p = 0.588p=0.588

The interpretation of this analysis is that Spearman's Correlation is very low and not significant, suggesting minimal or no ordinal relationship of the perception between the effectiveness of governance system capability and enforcement and oil mining's impact on economic problems. This indicates that the efficiency level of the governance system does contribute to the consequence of oil mining on nearby natural resource system, economic opportunities, social wellbeing and Nigeria's economic problem. This suggest that other factors might also influence the economic outcomes in the SES.

7.3.3.1 Evaluation of the relationship between the perception of household income sources of people living in communities around oilfields and the economic condition of the communities.

Table 32: Statistical Analysis and Crosstabulation of Evidence on Perception Household Income Sources and Economic Condition of Communities Around Oilfields (Chi-Square Tests)

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	181.766[a]	9	<.001
Likelihood Ratio	152.728	9	<.001
Linear-by-Linear Association	35.717	1	<.001
N of Valid Cases	388		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 6.56.

Table 33: Statistical Analysis and Crosstabulation of Evidence on Perception Household Income Sources and Economic Condition of Communities Around Oilfields (Symmetric Measures)

		Value	Asymptotic Standard Error[a]	Approximate T[b]	Approximate Significance
Ordinal by Ordinal	Spearman Correlation	.307	.061	6.331	<.001[c]
N of Valid Cases		388			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

c. Based on normal approximation.

The interpretation of this analysis is that there is a significant relationship between household income sources and the economic condition around oil mining communities. The chi-square tests and symmetric measures both indicate that the way household income sources are reported is associated with perceptions of economic conditions. The moderate positive correlation suggests that changes in household income sources are moderately associated with changes in perceived economic conditions.

7.3.3.2 Evaluation of the relationship between the perception of household income sources of people living in community around oilfields and the economic consequences of oil mining in natural resource system contribution to Nigeria's economic problems.

Table 34: Statistical Analysis and Crosstabulation of Evidence on Perception Household Income Sources Around Oilfields and Nigeria's Economic Condition (Chi-Square Tests)

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	27.337[a]	6	<.001
Likelihood Ratio	25.721	6	<.001
Linear-by-Linear Association	1.148	1	.284
N of Valid Cases	388		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 7.65.

Table 35 Statistical Analysis and Crosstabulation of Evidence on Perception Household Income Sources Around Oilfields and Nigeria's Economic Condition (Symmetric Measures)

		Value	Asymptotic Standard Error[a]	Approximate T[b]	Approximate Significance
Ordinal by Ordinal	Spearman Correlation	.009	.058	.182	.856[c]
N of Valid Cases		388			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

c. Based on normal approximation.

Interpretation of Results

1. **Chi-Square Tests Results:**
    - **Pearson Chi-Square Value:** 27.337, df = 6, $p < 0.001$
    - **Likelihood Ratio:** 25.721, df = 6, $p < 0.001$
    - **Linear-by-Linear Association:** 1.148, df = 1, $p = 0.284$

The Pearson Chi-Square and Likelihood Ratio tests show p-values less than 0.05, indicating a statistically significant association between household income sources and the belief about oil mining's impact on economic problems.

The Linear-by-Linear Association p-value (0.284) is much higher than the conventional significance level of 0.05, suggesting no significant linear association.

2. **Symmetric Measures:**
    - **Spearman Correlation:** 0.009, $p = 0.856$

The interpretation of this analysis is that Spearman's Correlation is very low and not significant, indicating a weak or negligible relationship between household income sources and the belief about oil mining's impact on economic problems. Since the p-values for both the chi-square tests for all the identified natural resource units and the symmetric measures

are less than the common significance level of 0.05, the null hypothesis is accepted. This indicates there is a no significant relationship between of the perception between SES condition and the Nigeria's economic problems. However, households with varying income sources may have varying levels of experiences in the SES condition that contribute to Nigeria's economic problem.

7.3.3.3 Evaluation of the relationships between the perception of economic condition in communities around oilfields and the economic consequences of oil mining in natural resource system contribution to Nigeria's economic problems.

Table 36: Statistical Analysis and Crosstabulation of Evidence on Economic Condition of Communities Around Oilfields and Nigeria's Economic Problems (Chi-Square Tests)

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	32.773[a]	6	<.001
Likelihood Ratio	30.204	6	<.001
Linear-by-Linear Association	3.363	1	.067
N of Valid Cases	390		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 7.04.

Table 37: Statistical Analysis and Crosstabulation of Evidence on Economic Condition of Communities Around Oilfields and Nigeria's Economic Problems (Symmetric Measures)

		Value	Asymptotic Standard Error[a]	Approximate T[b]	Approximate Significance
Ordinal by Ordinal	Spearman Correlation	.033	.058	.655	.513[c]
N of Valid Cases		390			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

c. Based on normal approximation.

Interpretation of Results

1. **Chi-Square Tests Results:**
    - **Pearson Chi-Square Value:** 32.773, df = 6, $p < 0.001$
    - **Likelihood Ratio:** 30.204, df = 6, $p < 0.001$

- **Linear-by-Linear Association:** 3.363, df = 1, p = 0.067

The Pearson Chi-Square and Likelihood Ratio tests show p-values less than 0.05, indicating a statistically significant association between the economic condition around oil mining communities and the belief about oil mining's impact on economic problems.

The Linear-by-Linear Association p-value (0.067) is just above the conventional significance level of 0.05, suggesting a potential trend but not a strong linear association.

2. **Symmetric Measures:**

- **Spearman Correlation:** 0.033, p = 0.513

Spearman's Correlation is very low and not significant, suggesting minimal or no ordinal relationship. But, the chi-square tests indicate a significant relationship between the economic condition around oil mining communities and the belief that oil mining contributes to Nigeria's economic problems. Despite the significant chi-square results, the non-significant Spearman Correlation suggests that the practical strength of this relationship is limited.

7.4 Relationship Between Descriptive and Inferential Evaluation of Statistical Result

Reviewing the Chi Square and Spearman Correlation statistics with the descriptive analysis reveal that the identified natural resource units play an increasingly important sustenance and livelihood role in the survey setting. The identified relationship between results from selected descriptive analysis results and inferential analysis on the ecological, social, governance system and economic effects suggest that the statistical association are not entirely due to chance factors. Therefore, considering the specificity of the interacting SESF variables in the Niger Delta oil mining context, this statistical analysis has demonstrated that there is a relationship between the effectiveness of governance system capability and enforcement, social-ecological system condition, household income level and micro-community condition with spill over on Nigeria's social-economic outcome. A key transferable

feature of these analysis results supports the outlining of the research findings in the quantitative analysis segment of this study (see Table 38).

Table 38: Testing the Sequential Mixed-Methods Data Analysis Results on the Social-Ecological System Outcome Effects

Qualitative Analysis Outcome Effects (Variables Tested from Quantitative Perspective)	Themes	Quantitative Findings
<u>Ecological System Effects</u> • Quantity and quality of food crops, fishery, livestock harvests. • Energy crops, including fuelwood and charcoal wood. • Available plant species for indigenous medicines. • Size and quality of wetlands and coastal ecosystems • Key geographical features. • Number and persistence of cultural celebrations. • Potentials of food, aquatic life, rare Availability of markets for resource units harvest.	Natural Resource System Condition	• About 56% of the population directly depend on the natural resource system that spread across terrestrial, coastal and marine ecosystems for sustenance and livelihoods. • This study provides evidence of the quality and quantity of farm crops harvests, aquatic products harvest plant forest and wildlife contribution to household income and communities' economic condition.
<u>Social Effects</u> • Ratio of Dependency on natural resource system. • Level of trust within SES. • Social-cultural attachment, health and security concerns in the survey setting. • Incidents of social agitations and conflict resolution mechanisms.	Social Institutions Effective Level	• There is corroborative evidence of mistrust between the communities on the one hand and on the other, their leadership, the oil companies' actors and regulatory agencies suggesting unpredictability of the informal and formal institutions. • The statistical evidence indicating a significant relationship between health condition in social-ecological system near oilfields implies that variations in health conditions are related to changes in household income sources in the context of oil mining communities.
<u>Governance System Effects</u> • Governance system transparency and accountability. • Impact of operational rule on resource systems. • Access to education, healthcare, fresh drinking water, motorable roads and housing. • Security status of communities around oil mining communities.	Governance Enforcement Effectiveness Level	• Statistical results indicate a significant relationship that the effectiveness level of the governance system does contribute to the consequence of oil mining on ecological system condition, economic opportunities and social wellbeing with broader impact on the Nigerian economic problem. • This study provides evidence of a survey respondents' general perception of the unreliability of the basic social amenities and public infrastructure in the survey setting.

		• The 55.1% respondents with the perception of the social actors enforcing governance system inability to build cordial relationship with the indigenous and resident social actors, provide a statistical evidence that suggests the reason for conflictual situations and social crises in the survey setting. • The respective 21.7% and 47.5% indicating the need to improve governance system capability and enforcement level for safeguarding social-ecological system condition, sustenance and livelihood suggest the perception effectiveness of governance system performance in the survey setting.
	Security Condition	• Statistical evidence indicates that variations in the security situation are associated with differences in household income sources, potentially reflecting how experiences with security influences perceptions economic status. These perceptions imply that variations in security conditions are moderately related to changes in household income sources in the survey setting. Likewise, variations in the security situation are associated with differences in household income sources, potentially reflecting how experiences with security influences perceptions economic status.
<u>Economic Effects</u> • Designation of resource units as livelihoods sources. • Income from harvested resource units. • Employment benefits from oil mining. • Transaction cost around oil mining communities. • Economic contribution of oil mining to proximal communities. • Livelihood generation from fishing, farming, forest formation and tourism around Context.		• From the statistical evidence there are perceptions of large percentage of the indigenous and resident social actors' dependence on occupation such as fishing, farming and trading for sustenance and livelihood in the survey setting. • This study found evidence of a perception of a significant relationship between household income sources and the economic condition around oil mining communities, suggesting that that changes in household income sources are associated with changes in perceived economic conditions. However, households with varying income

• Human development indices such as educational level, employment rate, health indices, Income level, poverty ratio.		sources may have varying levels of experiences of the SES condition contribution to Nigeria's economic problem. Likewise, the finding could imply that respondents' perception of the impact of oil mining on natural resource system are influenced by their income levels, possibly reflecting different levels of dependency on these resources for sustenance and livelihood. • The percentage of the survey respondent that indicated that the oil mining consequences outcome on economic opportunities and social wellbeing contribute to the Nigerian economic problems is 68.8%, while 16.8% believe otherwise.

Table 38 present the summary of findings from the descriptive and analytical data analysis of questionnaire survey evidence. For clarity, these findings complement and tests the revealed thematic analysis findings in the qualitative data analysis segment for the purpose of corroboration and confirmation.

7.5 Chapter Summary

This quantitative analysis chapter has analysed field survey evidence using descriptive and inferential statistics. The results and findings have provided empirical answers to achieve research Objectives 7 and complement Objectives 5 and 6. Although, the data analysis relies solely on descriptive statistical results to identify the relationship between quantity and quality of natural resource system value harvests and household income, the results and findings in the other selected descriptive analysis results and inferential statistics complements and corroborates each other. Therefore, this perception of the ineffectiveness of governance system capability and enforcement suggest the unpredictability of informal institution or formal institutions either independently or in convergence. The unpredictability contributes to the consequence of oil mining on nearby natural resource system with impact on social-ecological system stewardship, household income and micro-community condition with broader concern on health and security impacts. This statistical analysis finds a significant relationship between of the perception between social-ecological system condition and the Nigeria's economic problems. However, households with varying income sources may have varying levels of experiences in the SES condition that contribute to Nigeria’s economic problem. The data analysis results from the qualitative, descriptive and inferential statistical analysis corroborate each other to different degrees.

Chapter 8

Integration and Interpretation of Data Analysis

8.1 Introduction

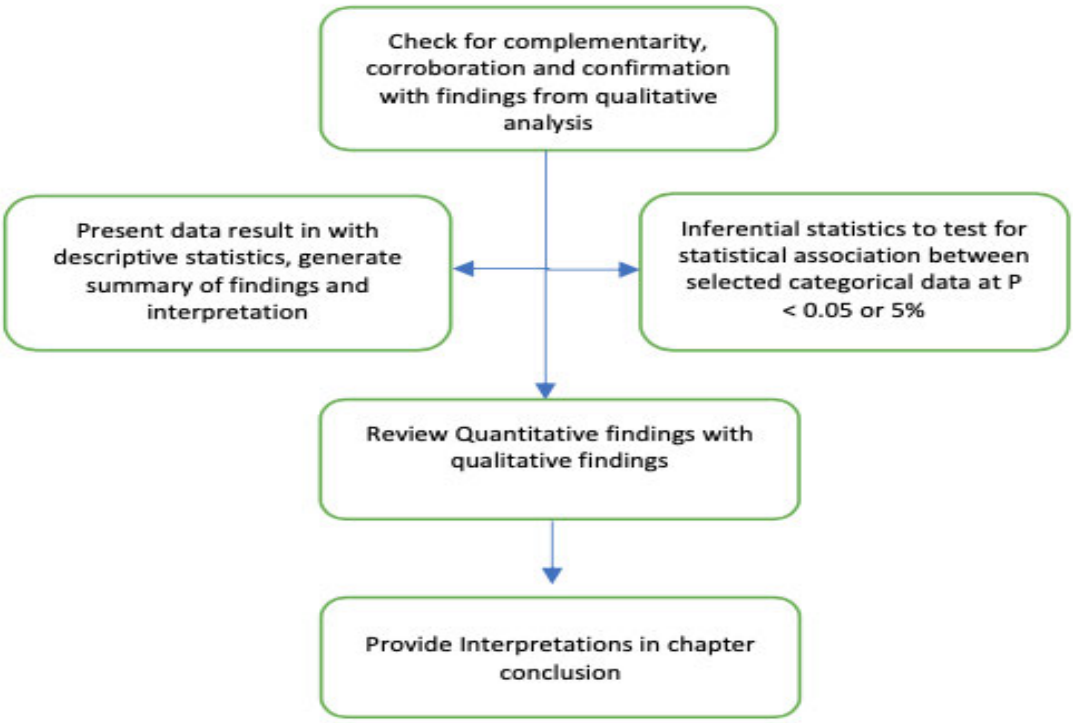
This chapter combines and reviews the results from the different data analysis segments (Chapters 6 and 7) to assess the research findings for complementarity and corroboration, and interpretation in line with Objective 8 “to complete Objective 5, integrate and compare the data analysis results and findings from both phases of data analysis to comprehensively explicate relationships between the natural resource management and the social-economic problem.” Assessing the complementarity and corroboration between qualitative thematic data analysis and the statistical results from Pearson Chi-Square and Spearman Correlations offers a comprehensive interpretation of research findings, thereby substantiating the advantages of sequential mixed-methods data analysis which engages qualitative techniques to enhance the richness and depth, while maintaining the objectivity of research findings with the quantitative results. Thus, this research findings achieve generalisability to similar context this experiencing the phenomenon.

8.2 Background

The result from the field data analysis has been processed through sequentially mixed-methods analysis in Chapter 6 and 7. This study found empirical evidence of the interaction within the SES around oilfields impact on social-economic outcome. Moving beyond a unidimensional perspective adopted by earlier studies to interpret the research phenomenon, this study reflects a rich and broad description of the natural resource system value flow to different social actors in their SES and the social-economic outcome. The research findings from the different data analysis segments are matched against each other

to develop an evidence-based interpretable relationship (see Table 29) by comparing the research findings from the two segments of data analysis. For context, evidence from two sets of interviews of n=30 comprising resident social actors driving sustenance and livelihoods in the survey setting and expert witness perception with practical working experience around the broader oil mining context. Then structured survey evidence from survey questionnaires to n=395 comprising 73.3% (62.3% male and 37.2% female) with real-life experience of ecological system dynamics in communities around oilfields. By combining findings from qualitative and quantitative studies in a unified interpretation, this study provides a comprehensive explanation for the research phenomenon (see Table 49).

Figure 18: Illustration Data Analysis and Result Interpretation



Understanding how and why people allocate and access natural resource system values in the SES around oilfields shows the importance of integrating and interpreting the findings (see Figure 18). The findings are classified into the outcome effects across the data analysis chapters to unify findings across identical emergent themes from the coding exercise.

Table 39: Testing the Sequential Mixed-Methods Data Analysis Results on the Social-Ecological System Outcome Effects

Qualitative Analysis Outcome Effects (Variables Tested from Quantitative Perspective)	Themes	Summary of Qualitative Findings	Summary of Quantitative Findings
<u>Ecological System Effects</u> • Quantity and quality of food crops, fishery, livestock harvests. • Energy crops, including fuelwood and charcoal wood. • Available plant species for indigenous medicines. • Size and quality of wetlands and coastal ecosystems • Key geographical features. • Number and persistence of cultural celebrations. • Potentials of food, aquatic life, rare Availability of markets for resource units harvest.	Natural Resource System Condition	• Despite the biodiversity of the natural resource system, consequences of oil mining reportedly suppress its productivity as social actors' sustenance and livelihoods sources. • Data analysis results from this study suggest a linkage between oil mining externalities in form of oil spillage and gas flaring impact the social-ecological system with broader threat to the quality and quantity of farm crops, fishery products and fresh water harvests in communities near oilfields. • A noticeable dilemma from the qualitative thematic analysis result is that oil mining activities transfer their private costs through externalities to the social-ecological system with disproportionately impact on indigenous and resident social actors.	• About 56% of the population directly depend on the natural resource system that spread across terrestrial, coastal and marine ecosystems for sustenance and livelihoods. • This study provides evidence of the quality and quantity of farm crops harvests, aquatic products harvest plant forest and wildlife contribution to household income and communities' economic condition.
<u>Social Effects</u> • Ratio of Dependency on natural resource system. • Level of trust within SES.	Social Institutions Effective Level	• Aside from sustenance and livelihood sources, other attributable values to the natural resource system is based on its habitat, intrinsic, traditional worship,	• There is corroborative evidence of mistrust between the communities on the one hand and on the other, their leadership, the oil companies' actors

• Social-cultural attachment, health and security concerns in the survey setting. • Incidents of social agitations and conflict resolution mechanisms.		recreational, transportation, medicinal and nutritional values to indigenous social actors. • Beyond the challenge of the effectiveness level of governance system enforcement, the local social actors' mistrust for their community leadership based on the perceived belief of their self-interest pursuit suggest the unpredictability of informal institutions. • There is a perception of health complications and security concern from the consequence of oil mining on indigenous and resident social actors.	and regulatory agencies suggesting unpredictability of the informal and formal institutions. • The statistical evidence indicating a significant relationship between health condition in social-ecological system near oilfields implies that variations in health conditions are related to changes in household income sources in the context of oil mining communities
<u>Governance System Effects</u> • Governance system transparency and accountability. • Impact of operational rule on resource systems. • Access to education, healthcare, fresh drinking water, motorable roads and housing. • Security status of communities around oil mining communities.	Governance Enforcement Effectiveness Level	• The inability to identify, explore and standardise the values attributed to natural resource system, its extraction process and the stewardship for SES safeguard suggest a lack of governance system perceptiveness of the value of non-oil resource potential in the survey setting. • The unpredictable nature of informal institutions administering customary rights in the SES, and their influence on natural resource extraction, contributes to trade-offs, suppression of	• Statistical results indicate a significant relationship that the effectiveness level of the governance system does contribute to the consequence of oil mining on ecological system condition, economic opportunities and social wellbeing with broader impact on the Nigerian economic problem. • This study provides evidence of a survey respondents' general perception of the unreliability of the

		sustenance and livelihood source which contributes to conflictual situations. This challenge is compounded by the governance system authorised by the federal law to regulate oil mining activities. • The inability to hold oil corporations to fully account for their oil mining externalities by the governance system with converging sets of laws, suggest that the centralised natural resource management approach subordinates the land use act and customary rights from safeguarding the SES in the survey context. • The wide perception of the unreliable basic social infrastructure condition, despite the influx of migrant workers to the rural communities for oil mining activities suggest the perceptiveness of the governance system capabilities and effectiveness in the survey setting.	basic social amenities and public infrastructure in the survey setting. • The 55.1% respondents with the perception of the social actors enforcing governance system inability to build cordial relationship with the indigenous and resident social actors, provide a statistical evidence that suggests the reason for conflictual situations and social crises in the survey setting. • The respective 21.7% and 47.5% indicating the need to improve governance system capability and enforcement level for safeguarding social-ecological system condition, sustenance and livelihood suggest the perception effectiveness of governance system performance in the survey setting.
	Security Concern	• This study provides evidence of unpredictability of oil mining externalities that is randomly offloaded on the SES, imposing a public cost that contributes to conflictual interactions in the survey setting.	• Statistical evidence indicates that variations in the security situation are associated with differences in household income sources, potentially reflecting how experiences with security influences perceptions

		• Qualitative thematic results suggest that the inability of the governance system to enforce the applicable sanctions for regulatory infractions on the social-ecological systems when the oil companies contravene the oil mining operational laws influences conflictual issues and security concerns that disproportionately affects other social actors' ability to source sustenance and livelihood.	economic status. These perceptions imply that variations in security conditions are moderately related to changes in household income sources in the survey setting. Likewise, variations in the security situation are associated with differences in household income sources, potentially reflecting how experiences with security influences perceptions economic status.
<u>Economic Effects</u> • Designation of resource units as livelihoods sources. • Income from harvested resource units. • Employment benefits from oil mining. • Transaction cost around oil mining communities. • Economic contribution of oil mining to proximal communities. • Livelihood generation from fishing, farming, forest formation and tourism around Context. • Human development indices such as educational level, employment rate, health indices, Income level, poverty ratio.		• There is a perception that the revenue from oil mining activities threatening other natural resource system values may only generate short-term revenue flow to the national economy, as against the long-term consequences on the social-ecological system sustainability. • Qualitative thematic analysis results provide evidence of the relationship between natural resource configuration, food cultivation, fishery, food processing and livelihoods sources and employment. • This study suggests that the practice of treating oil mining consequences on social-ecological systems along with the	• From the statistical evidence there are perceptions of large percentage of the indigenous and resident social actors' dependence on occupation such as fishing, farming and trading for sustenance and livelihood in the survey setting. • This study found evidence of a perception of a significant relationship between household income sources and the economic condition around oil mining communities, suggesting that that changes in household income sources are associated with changes in perceived economic conditions. However, households with varying income sources may have

		associated outcome as externalities inadvertently underestimates the deep implicit social costs on sustenance and livelihood sources and suggests governance system imperceptiveness. • The social actors participating in this study perceive that the first causalities of natural resource system breakdown are individuals and households whose sustenance and livelihood are sourced directly or indirectly from the natural resource system productivity. • The study provides evidence of a perception that the applying penalties, taxes, subsidies and payments of compensation as a form of regulatory control of oil mining externalities does not fully capture the explicit and implicit public costs imposed on the social-ecological system. This research suggests that the existing policy incentivises mining social actors to believe that there is a price tag for SES depletion.	varying levels of experiences of the SES condition contribution to Nigeria's economic problem. Likewise, the finding could imply that respondents' perception of the impact of oil mining on natural resource system are influenced by their income levels, possibly reflecting different levels of dependency on these resources for sustenance and livelihood. • The percentage of the survey respondent that indicated that the oil mining consequences outcome on economic opportunities and social wellbeing contribute to the Nigerian economic problems is 68.8%, while 16.8% believe otherwise.

Table 39 illustrate the interconnection between the research objectives, SES Outcome (categorised into ecological, social, governance system and economic effects), the findings generated from the qualitative analysis in chapter 6 and quantitative analysis in chapter 7 are classified under the emergent themes. From presenting the separate findings from the qualitative and quantitative data analysis for comparison along the emergent themes from the qualitative data analysis, the results complement, corroborate and confirm each other in line with the sequential mixed-methods objective.

8.3 Social-Economic Outcome

8.3.1 The Ecological Effects

This survey conducted for this study recruited respondents from a wide range of backgrounds providing a unique insight into how they view their common-pool natural resource system. They reported the natural resource system on which they rely on for sustenance and livelihood represent a rich biodiversity that provides for communities beyond the oil mining activities. The research findings (see Table 39) present both qualitative and quantitative evidence of the perceptions of a natural resource geography that combines a healthy natural environment, fertile land, diverse farm produce and medicinal plants, tropical rainforest and mangrove forest, large bodies of water, diverse fishes, and other seafood that equally provide the satisfaction of non-economic human wellbeing. Also, the findings suggest that the configuration of the natural resource system (RS) and the identified natural resource units (RU) provide employment support for vulnerable social groups including women and youths. Likewise, the configuration of the natural resource system is perceived to influence the ratio of dependency on the natural resource system and community economic development in the survey setting. This finding suggests that the natural resource system productivity and replenishable cycle contribute to human well-being and social-economic outcomes in the communities concerned. For clarity, the natural resource units in the survey context comprise the quality of water sources for household domestic, the quality of plants, forests, and wildlife, the quantity and quality of fish and other seafood caught from the nearby rivers and sea, and the and the quantity and quality of farm crops harvested. Thus, any disturbance of the natural resources system has effects on household income, the economic condition of the community, and the natural biodiverse life of plant and animal species. However, informal economic endeavours around local communities often operating

with a consciousness of the interconnectedness between people, the environment and economy are often characterised by undocumented nature. Thus, although the challenge is obvious to the social actors in the social-ecological system around oilfields, by could be obscured to policy actors who may be faced with the unique challenge of evaluating informal statistical data, especially in the context where survey evidence from this study suggest a mistrust between government entities and local community residents.

Conversely, the reported series of oil mining externalities on the SES condition reveal that oil mining activities impose private costs that feedback on the natural resource system capacity in the survey context. Yet, any ineffectiveness in the governance system regulating oil mining results in the inadvertent suppression of non-oil related the natural resource system. Yet, any economic activities that contributes to the degradation of the value of the natural resource system equally generates vulnerability to households and communities nearby oilfields. Nevertheless, because the ratio of dependency on the natural resource units for the national and subnational governments is different from the indigenous and resident social actors, social-ecological system disturbance in the survey contexts have reportedly contributed to conflictual situations and abnormal behaviours among the community youths. However, the two data analysis results suggest that the governance system is yet to comprehend or simply overlooks the linkages from common-pool natural resource system to household income, communities' social-economic progress, and its overflow to the national social-economic outcome. Thus, the qualitative finding reveals that the non-oil related natural resource unit preference of households and nearby communities are subordinated by the governance system preference for oil mining. For example, 76% survey of respondents indicated that the governance system to safeguard the SES is ineffective. Yet, the ecological effect that threaten the harvests of quality and quantity of natural resource values, can also

impaction on food production, processing and supply, food insecurity, household income, unemployment, and poverty.

As this research show there exists a multi-dependency and interdependency of the communities on natural resource system to provide habitat for biodiverse plant and animal species. Oil mining externalities therefore represent far more than loss of food production, including the sustainability of ecosystem service provision. Both qualitative and quantitative results corroborate the linkage to an intricate web of the food production system, food sufficiency, cheaper food supply and employment to natural resource system productivity. This suggests that if the combination of factors guaranteeing the common-pool natural resource system productivity is lacking, the effects of the consequences of oil mining activities on the terrestrial, coastal, and marine ecosystems can influence the social-economic outcome negatively. Besides, statistical evidence from this study reveals that changes in perception of quantity and quality of farm crops, fish and seafoods harvests and water sources for domestic use are related household's income sources. Likewise, there is significant relationship between household income and the economic condition of communities around the oil mining context. Bringing these data analysis results together, this study can suggest that at the household, community, subnational and national levels, the evidences of an social-ecological system sustainability consciousness can be beneficial to natural resource-dependent economies.

8.3.2 The Social Effect

Evidence from the qualitative result on the social effects of SES degradation provides richer and more in-depth insights than findings (see Table 39) from previous study on this research problem. For example, the results suggest that the consequences of oil mining in the survey setting dislocate social actors from their social-cultural habitats (see evidence from

OIE04 in Page 206). This evidence unravelled one of the factors underlying the multiple contestations between Petroleum Industry Act (2021) and customary rights that influence conflictual situation and social agitations. This finding suggests that centralising an ineffective governance system to regulate oil mining activities automatically imposes public costs on social actors grossly dependent on natural resource systems in social-ecological system around oilfields. Yet, from the statistical result social-ecological system crises influence by the consequences of oil mining, an estimate 36% of the people never received any form of support, as against 9% and 19% that receive palliatives from governance and oil companies in the survey context respectively. For the category of vulnerable social actors who are already natural resource-poor, the only alternative for sustenance and livelihood is drawing attention to SES stewardship, interaction with natural resource system extraction accountability. Otherwise, increase security concerns over social justice through agitations and protests events are the last resort according to the survey perception (58%) as against (15.5%) in the survey setting. This challenge is despite polycentric governance system comprising the Petroleum Industry Act (2021), the Land Use Act of 1978 and Customary Rights regulatory social interactions at multiple level and scale (see Chapters 2 and 3). Although, the natural resource system is vital for livelihoods of indigenous and resident social actors. However, the identified evidence of ineffective level of governance system capability and enforcement seem to compound social-ecological system stewardship challenge, leave the people vulnerable to social, ecological and economic system challenges. As revealed by data analysis, it is the expression of frustration and emotions to the ecological effects of the persistence oil pollution and gas flaring that contribute to the community leadership mistrust, conflictual situations and unpredictability of informal institutional structures in the survey context.

From the social-cultural stewardship perspective, it determines resource conservation, exploration, production, and consumption, which are central to their identity, underpinned by beliefs and norms guided by local community leadership. But when the informal institution is fragile and unpredictable, the SES stewardship by social groups is jeopardised, representing the failure of the first-line social-ecological system safeguard in the survey setting. From the social-cultural point revealed in the qualitative evidence, the natural resource system potentiality is not only important because of its social-economic potentials, it also contains intrinsic value that serves as a store of ancestral value for the upcoming generations. For example, the leaders are compelled *"to swear an oath"* (ORN10) of commitment based on cultural belief against the pursuit of self-interest. Nevertheless, despite the oath-taking, some leaders reportedly defied allegiance to the collective communal goal for self-interests. This social accountability approach suggests that individual choices and actions within informal institutions are to some extent social-culturally conditioned. Yet, data analysis results have reported that natural resource system access, extraction and transformation can be influenced by the behaviours of local community members, leaders and external actors. On a broader level, the degree of that social capital accruing to local community leadership is reflected on their breach of collection action trust can threaten the social, ecological and economic systems stability in the survey setting when collective expectation of the stewardship of the social-ecological system is different from the reality. Accordingly, although the study evidence has identified capability and enforcement challenge of the centralised governance system. However, the local communities' leadership at the lower level of social-ecological system stewardship is also perceived to experience its own capability and enforcement challenges.

8.2.3 The Governance System Effect

The plurality of evidence underpinning the social-economic outcome around oil mining contexts has been analysed from the qualitative and quantitative perspectives. The quantitative study applied proxy indicators to generate results on the social-economic outcome of interactions with the SES. The study findings (see Table 39) uncovered the differences in the way social actors interact and derive value from the SES and how the governance system actors enforce the operational regulations and by doing so, generate their own social, ecological, and economic effects. The natural resource governance system prioritises revenue proceeds in the form of direct profits, royalties, taxes, and penalties as enshrined in the PIA (2021) that is shared monthly between the federal government, sub-nation states, and local government council based on an apportioned formula. Whereas local social actors in the sub-nation states and local government councils, especially in the Niger Delta area under study, rely on oil revenue subvention, pay-as-you-earn taxes, and levies on social-economic activities. However, with low trickledown effects of the federal subvention from oil revenue proceeds, the social actors in the survey context that are principally dependent on sustenance and livelihoods from traditional agriculture and fishing, food processing, trading, and other forms of self-employment, suggest significant relationships between household income level, the micro-community economic condition and the social-ecological system around oilfields.

From another result, a significant relationship identified the perception that economic conditions around oil mining communities contribute to Nigeria's economic problems. However, the nature of outcome of the relationship between the economic condition in communities near oilfields and nation economy is dependent on governance system capability and enforcement effective. Although, secondary datasets suggest that the Nigerian

economy is both dependent on agricultural cultivation and fishing engagement as well as oil mining revenue. However, from the data analysis result in this this, it is unclear if policy actors have considered the net economic value of social-ecological system safeguard to the different sectors of the social-economic system. Thus, the governance system dominancy that is perceived to constrain local social actors' capability to determine what, why, and how the natural resource system is valued, regulated, explored, and transformed for household's income and micro-community economic condition in the social-ecological system around oilfields, may be inadvertently trading off its social-economic wealth. Moreover, the identified unpredictability of the interdependency between informal and formal institutions to provide social-ecological system safeguard for harnessing the different layers of social-economic potentials may reflect the imperceptible costs of governance system capability and enforcement ineffectiveness in natural resource-dependent contexts.

The study submits that the effectiveness level of governance systems capability and enforcement as deduced from data analysis results clearly departs from the notion of crosscutting and bottom-up economic development that could have been driven through social-ecological system stewardship. Also, the results suggest that different social actors' interests and attributed values to the natural resource system differs, whereby nearby households' income and micro-community economic levels are affected not only by their natural resource extraction and transformation, they are impacted by the persistence of the public costs from oil mining externalities because oil mining social actors are not fully held accountable to internalize all the costs imposed on the social-ecological systems around oil mining fields. This argument precludes the possibility that governance systems might have reasons for action that are independent of the preferences of social actors living in nearby communities. Nevertheless, the governance system effects beyond the theoretical

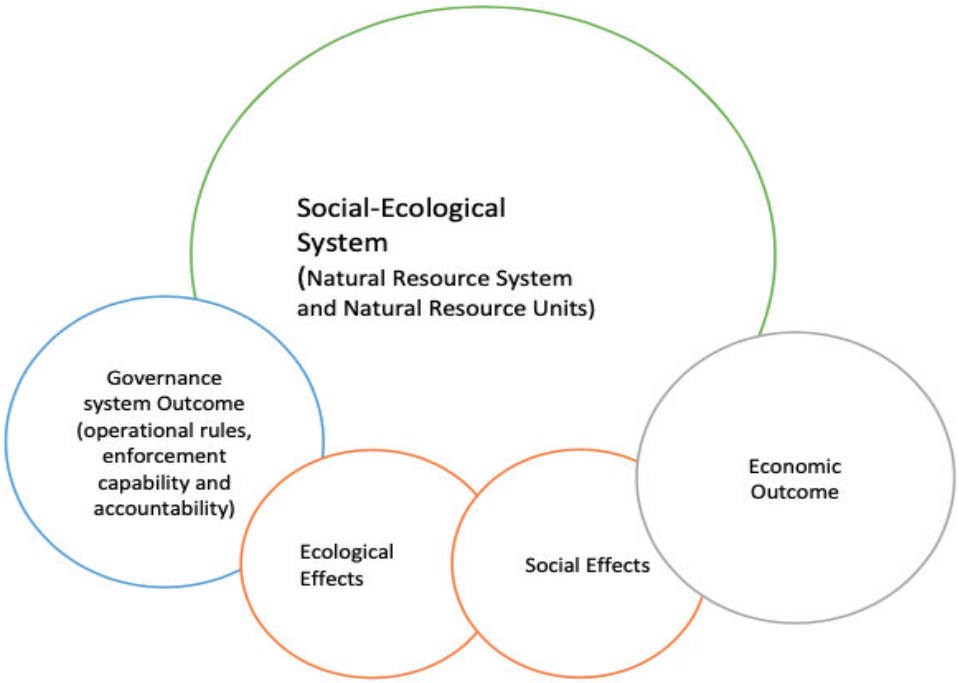
assumption might be irreducible to the divergent and substitutable preferences of the multiple social actors in the survey setting. But, relying on narrow specifiable criteria of oil mining regulation in a complex SES without considering the real-life consequences on other social actors is to pursue unidimensional perspective in social-economic development approach that poses social justice challenges. However, when people are faced with regulatory dilemmas either because of informal or formal institutions beyond their endurance threshold, people are likely to exhibit a different form of reasoning and behavior to survive real-life natural resource system problems that may be beyond governance system capability. This assumption might explain the persistent security concerns in the survey setting that manifest in form of the destruction of pipelines to steal crude oil, harvesting other people crops and other evidence of abnormal behaviors as revealed from data analysis results.

8.2.4 The Economic Effect

The plurality of evidence underpinning of the social-economic outcome around oil mining contexts reveal the most difficult challenges experienced in the survey setting. Also, statistical analysis reveals the relationship SES condition, household's income and the community economic condition of the communities. The natural resource governance system that rely on revenue proceeds in the form of direct profits, royalties, taxes, and penalties from oil mining activities as different from social actor's dependent on farming, fishing, food process and employment from natural resource system, suggest that the difference in social actors' attributable values to the social-ecological system safeguard in the survey setting. This suggest that the multiple social-economic outcome for the different social actors either on oil mining extraction or agricultural cultivation, fishing engagement and social-cultural attachment to the natural resource system influence the degree to the trade-off which any social actors are likely to consider in pursuit of social-economic potentials in the survey

setting. However, for the social actors grossly depending on the natural resource system, the consequence of oil mining activities impact on food crops harvest and fishery products harvest, food processing and supply, local traders patronising these communities for fishery products and employment of migrant workers have overflowing effects to other social-economic system. This discovery is just as the centralised governance system reprioritisation of sustenance and livelihood sources from the natural resource units in the SES will have overflowing effects on the social-economic systems. This suggest that any natural resource governance system decision in social-ecological system without holistically valorising the social, ecological and economic potential represent trade-off the combined social-economic potentials of the natural resources system below its true sustainability value, leading to a net loss for the future national economic system, despite present social-economic benefits. However, this research findings (see Table 39) suggest that distortion of social-economic potential for households and the three communities surveyed suggest that some social actors return on investment on farmland cultivation and fishing may discourage future investment, with broader impact on widening economic disparity between rural and urban areas.

Figure 19: The Visualisation of SESF Outcome Effects from Survey Evidence Analysis



From figure 19, the many relations and interactions between actors and ecosystem components in a given SES (green circle) are represented by the network of the emergent outcome. The governance system effects (blue circle) effectiveness level influence interactions within the SES that determine the ecological and social systems with broader implications on economic outcomes. The ecological and social effects (orange circles) interact within the SES to generate economic effects. This illustration interprets the interactions of evidence from both the qualitative and quantitative data analysis, which is considered relevant for theoretically explaining the combined research findings. These outcome variables and sub-variables that overflow to the social, ecological and economic system of households and micro community economy also feedback on the social-ecological system in other forms. This finding can be analysed in different ways. However, in societies depending on the linkage of ecological systems for household income and economic development, when the distortion

of this linkage is occasioned by ineffective governance system, the real natural resource system value might be discounted.

8.3 Chapter Summary

This SES study by integrating data analysis results from chapters 6 and 7 provides an empirical interpretation of interactions within a complex social-ecological system and the social-economic outcomes composed of different active elements. From the research findings the patterns of interactions have produced emergent properties that are not easily predictable from analysing the separate parts of the system. However, the research findings reveal the multiple levels and scale of relationship between the natural resource units, household income level, the economic condition of the local community level and the national economy outcome. Yet, the governance system effect remains contributory to shaping the pattern and outcome of these relationships. This suggest that any governance system that is unable to manage the multidimensionality of natural resource system values may be insensitive to the obvious and not so obvious social, ecological and economic system potential in natural resource-dependent contexts. It is the lack of understanding or overlooking of the complex multiple levels and scale of interactions in the social-ecological system near oilfields that influence the unpredictable of institutional structures and system, either between informal and formal institutions interdependency or independently. This, unpredictable informal and formal institution interdependency represent the imperceptible costs on the SES that are often not reflected in natural resource-dependent economic performance. analysing and interpreting the complex interaction of these active elements in the survey setting holistically, justifies the operationalisation of the SES diagnostic framework using sequential mixed-methods approach.

CHAPTER 9

DISCUSSION

9.1 Introduction

Nigeria's economic phenomenon has been theorised from different perspectives based on its natural resource management challenge. However, identifying new empirical gaps, the study considered a new philosophical standpoint guiding the theoretical framework using the research Objectives 4 and 5. To interrogate this phenomenon, the Pragmatist's Instrumentalist philosophy supports a mixed-methods approach for gathering and analysing evidence representing human real-life experiences in the SES around oil mining fields. From the data analysis chapters, the study result and findings discovered a complex blend of multiple interactive factors, intersecting social actors' interaction, natural resource system extraction, governance system design, capability, and enforcement within the SES reflected as the social-economic outcome. Building on this knowledge, key findings are discussed in this chapter, as well as contributions to natural resource management, SES stewardship, sustenance, and livelihood source safeguarding.

9.2 Key Social-Ecological System Outcome Variables Interpreting Nigeria Phenomenon

From the analysis of the field evidence, the study has resolve studying the Nigeria social-economic problems from the social-ecological system perspective to understand economic complications natural resource-dependent contexts. These answers were discovered by interrogating the influence of the effectiveness level of governance system enforcement on social-economic interactions within the SES around oilfields. This implies that previous studies argument linking the social-economic outcome of natural resource context to effective institutions (Stevens, 2015, Auty, 2017) has been resolved. For example, data analysis result reveals that 76% of the survey respondents do not think how oil industry regulatory agencies

enforce regulations provides social-ecological system safeguard. This result raises important issues for natural resource system productivity for household's productivity and community development. However, after generating three primary pieces of evidence from the everyday experiences of human populations in the survey setting, institutional capability and enforcement represent an important aspect of institution effectiveness. For example, from the four outcome effects (ecological, social, governance system, and economic) identified that threaten the sustenance and livelihood sources in the survey setting, governance system capability is suggested as a common factor that influence the outcome.

9.3.1 The Ecological Effects

This section explores the perceived losses of natural resource values that contribute to economic leakages threatening households' well-being and the social progress of their community. The research findings have identified the multiple interactions and consequences in the SES where different social actors draw ecosystem services such as, fresh air, water supply, food production, nutrient provision, medicinal products, employment, livelihood, and natural social infrastructure systems. However, the relationship of the natural biodiversity losses, including the destruction of rare plant and animal species from the consequences of oil mining, a subject that was almost absent when contemplating oil mining activities. These losses represent an inestimable social-economic system loss that is hardly reflected in national statistics as argued by Dasgupta (1995).

Field survey exercise discovered randomness of oil spills spreading pollutants on the natural resource system with implications on the diversity of sustenance and livelihoods. It is difficult to discuss institution effectiveness to social-economic outcome in natural resource-dependent context without referencing social-ecological system stewardship where natural resources are extracted. For example, in the Bomu community, Ogoniland, after over two

decades of abandoning oil-polluted sites, a survey respondent (ORN05) described the entire landscape as, *"Nothing grows there."* But, if this natural resource system has been devastated beyond an irreversible threshold, then access to its attributed values becomes unsustainable because of the unpredictability of its replenishable cycle and productivity. This finding suggests is that the ecological system that represents the ancestral home and residence to a diversity of people, cultures, and ideologies with multiple traditional knowledge and provides habitat for both scientifically recognised and yet-to-be-recognised genes and species in the natural biodiversity is exposed to harsh conditions that contributes to their reduction in resilience. Yet, the social-ecological system offers a variety of social-economic support to the different layers of the societal cadre especially to women and youths with few other sustenance and livelihood alternatives. When the social-ecological system condition is fragmentated from oil mining externalities, the social actors in nearby communities are collectively at risk of social-economic disenfranchisement, even if the other aspects of the economy enjoys growth from oil industry investment. Factoring in costs of the future scarcity of natural resource systems into these social-economic losses highlights, the implications of the trade-offs involving safeguard of SES safeguard for oil mining activities.

An important piece of evidence on the perception of the consequences of oil mining in the survey setting, is the freshwater contamination and the impact. For example, aside from the identified value losses, the quality of freshwater supply from the coastal system has been reported as contaminated with impacts on human sustenance and livelihood. However, the experience of water contamination from oil spill random, has influence local social actors to seek alternative sources of clean water supply for cooking, cleaning and processing food crops. The study identified evidence of people who patronise packaged sachet water periodically or invest in digging private or public wells or drilling boreholes (see Chapters 6

and 7). Reflecting on the field evidence of collective dependence on the groundwater as an alternative supply source and contamination, a former United Nations consultant, geologist, and university lecturer (OIE05) reported the contamination of the water system: "*coliform faecal contamination and also Benzene.*" Also, a local businesswoman in Ogoniland (ORN05) reported that *"so, some people dug a well that they use for drinking, I think all these things are not okay because the soil is contaminated."* Likewise, an environmental scientist working with an oil spillage clean-up in Nigeria reported that (ORN06) reported that *"what I am trying to say is, currently there is Benzene, and the water table is no good for consumption."* This report aligns with earlier evidence from laboratory analysis conducted in Ogoniland from the existing scientific findings (UNEP 2011) and recent discovery in nearby Bayelsa State (Sentamu et al., 2023). The implication of this social survey evidence the consequences of long-term oil mining and the effects of hazardous chemical levels on the water sources for drinking and food processing can be reflected in;

- The direct and immediate impairments on people experiencing health symptoms from consuming oil-contaminated water and other categories of people with unacknowledged health complications as an indirect result of oil industry processes.
- The social-economic burdens of accessing water through longer distances or the cost of investment in boreholes or wells.
- The broader consequences on natural biodiversity species supporting ecological system services for nutrient recycling.

From another perspective, the oil mining impact on SES condition can pose far-reaching difficulties of restoring the ecosystem to its original condition with non-linear effects on sustenance and livelihood sources. The implication of this social-ecological system disturbance is that the salient and invisible processes that support and shape the natural

ecological system replenishment have memory and path dependent (Dasgupta, 2022). Ecological system constituent's distortion can complicate their replenishment cycle during restoration. The value losses from any challenge of natural resource system restoration are perceived to be lopsided against the social actors whose sustenance and livelihood needs are dependent on it. But if the governance system provision allows each social actor to bear the contamination burden on social-ecological system equally, the enforcement of property rights and access to the natural resource system may be substantial different. The implication of distributed entitlement to the natural resource system in a polycentric governance system in the inability for any social actor to dominate any aspect of the natural resource system without mobilising participation, accountability and transparency in oil mining regulation. The enforcement priority accorded to oil organisations' social actors by subordinating the local social actors' customary rights and the inability to hold oil industry accountable for their consequence on the SES suggestively explains and shapes some conflictual situations and security concern in the survey setting. This research finding aligns with Mahler, (2011) argument.

Whereas, the natural resource system provides food, nutrition, medicine, hygiene, raw materials, energy, and cultural practice as critical aspects of household sustenance and income, as well as supporting micro-enterprises. But, when natural resource system values stressed by oil mining externalities is unable to meet the sustenance and livelihood needs of the social actors grossly dependent on it, it is unlikely that households in nearby communities will taking the social-economic outcome peaceably. Research findings has identified that households and communities depend differently on natural resource units for sustenance, employment, and livelihoods (see Chapters 6 & 7). Consequently, ecological system disturbance may resound in income inequalities and social-economic difficulties subject to

the ratio of dependence on the natural resource system. For example, a sustainable development expert consulting for an oil mining organisation reported that;

> *"And if the people cannot sustain their livelihoods in their environment, you are indirectly pushing them into poverty. So, the correlation is just direct. You can't detach poverty from a contaminated environment. And you can't detach a contaminated environment from the careless and unguarded actions of oil and gas operators with the Niger Delta." (OIE03)*

The study evidence confirms the customary rights-dependent social actors and their ecological system as the first casualties of the consequences of oil mining because of the distortion natural resource system linked to sustenance and livelihood sources. Yet, it is unclear if this elements of explicit and implicit costs on natural resource system depletion is appropriate captured in economic performance measurement. Likewise, this study is unsure if previous studies interpreting Nigeria economic performance from oil resource management perspective also modelled the poverty assessments from the consequences of oil mining activities. While these findings from a social-ecological system perspective study provide new evidence on the Nigeria's social-economic phenomenon, these insights can serve as important consideration for natural resource-dependent contexts social-economic performance assessments. This argues aligns with Folke et al. (1994), Bockstael et al. (2000) and Dietz and Neumayer, (2007) submissions.

9.3.2 The Social Effects

From the data analysis the identified social effect is the perception that the consequences of oil mining confer value losses on culturally rooted social actors who derive intrinsic benefits from the natural resource system. The reported uniqueness of the natural

resource system and ancestral linkages seem to influence the cultural attachment that shapes social values with economic benefits. For example, ORN10 reported that;

> *"And then there are also, for some persons, who also see the environment as a place where they carry out their worship. There are some that use clean water to worship the goddess of the river; they go there for inspiration, and they go there to also gain some; beyond the spiritual inspiration they get, they get inspiration that can help them, like woodcarvers, for instance. Woodcarvers will go there to get inspiration on how they can carve an image out. You know they imagine an image and make it out. Sometimes they say the way they carve what they are using for their dance steps may be how they can appease their gods and all that. So, there is quite a lot that people get from the environment beyond the economic benefits." (ORN10)*

This perceived sacred social-cultural practice provides a range of natural resource units that have been linked to acts of spiritual worship for some social actors, and livelihood sources for others carving articles of traditional worship for sale. The livelihood potential may be lost when the patrons of traditional worship become disinterested in performing these rituals in oil spillage contaminated social-ecological system. Likewise, there is a reported evidence of relationship between natural resource system values through (the wild supply and cultivation of certain food crops), social-cultural ideologies and easily and cheaply accessible dietary and nutritional ingredients for local cuisine (See Chapter 6). Although the value losses from natural wild food supply may threaten social actors' intrinsic, sustenance and livelihood values to their indigenous ecosystem. However, an often-non-reflected evidence in mainstream economists modelling is the intrinsic value loss of social-cultural detachment of some social actors who migrate to more conducive environment for economic opportunities. (see also Snyder et al, 2003). Besides, data analysis result provides preliminary insight of the

not-so-obvious indirect value of social-cultural attachment to the natural resource system to policy actors when conducting social-economic assessments (see Chapter 6).

Another aspect of the sustenance and livelihood problems discovered in this research is the local community leadership's responsibility to provide traditional guidance and mediation of conflictual situations for social stability (see Chapter 6). Nevertheless, while interview evidence reveals that some community leaders pursue self-interest, 71.9% of respondents from the quantitative analysis corroborated the evidence that community leaders are mostly interested in their personal interests. Besides, the inability of the community social actors, oil mining and regulatory agency social actors to develop cordial relationship suggest institutions unpredictability for the effectiveness of SES stewardship and its social-economic outcome. However, it is not clear if the social dilemma identified from the complications of governance system capability and enforcement could have been different had the organic evolution of sociological history not been truncated by colonial incursion (see Chapter 2). Consequently, rather than focusing on the fallibility of the centralized governance system, it is also important to consider in the evaluation of social constituents (comprising individual, households, voluntary groups, communities, and other human associations) underpinning the basic informal institutional structures coordinating interactions within the social-ecological system for daily sustenance and livelihoods.

In addition to the direct implications of non-viability of perceived leadership deficit in these communities, the distortion of the informal social contract could be suggested to symptomise the reported security concerns over social agitation, hostilities, and other acts of criminalities identified from data analysis (see Chapter 6). A key point of departure to frame this discussion is to recognise that where the basis for social trust is lacking among the subscribing social actors to collective action group, then social relationships and reciprocity

within the communities can become precarious. This suggest that informal and formal institutions without reinforced voluntary social-contract bargain are not necessarily efficient structuring natural resource governance institutions (See Chapter 2). The perceived ineffectiveness can impose indirect threats to social stability through individual and household's inability to access natural resource system values. This implies when community representative pursue self-interest above collective interest, the manner of unaccountability can drag the social, ecological and economic system stewardship in the survey setting. Yet, the strength of a collective system and particularly the customary right enforcement by informal institution has been identified to be subordinate and vulnerable to the authorities of the Land Use Act (1978) and the Federal Petroleum Industry Act (2021) (See Chapter 3). This may explain the vulnerability of the social-ecological system near the Niger Delta oilfields historically known to experience depletion to oil mining externalities despite the polycentric governance system in place (Sentamu et al, 2023). Nevertheless, interview evidence reported social actors awaiting the enforcement of the provisions of the most recent Petroleum Industry Act (2021) galvanise different interests and formal and informal power hierarchies towards commonalities for social-ecological system safeguard.

There are also benefits of the recreational values of the natural resources system based on the data analysis result. This evidence in Chapter 6 corroborates existing literature on the linkages between the exploration of the natural resource system's richness and the reduction of emotional responses such as anxiety and anger (Cunsolo and Ellis 2018). In this sense, if some social actors explore the natural resource system purposely for its recreational benefits, then any depletion, gradual degradation, or sudden disappearance of these natural recreational facilities could impose its own social effects. Moreover, as reported by IAN07 (see Chapter 6), the uniqueness and aesthetic beauty of their beaches attracts tourists to the

community, from as far as Lagos (a distance of about 750 kilometres), generates livelihoods for the locals who sell food and drinks, for the small businesses that provide accommodation and transport services, and levies for the local government authority. Accordingly, aside from the fiscal value attributed to the oil mining activities, the natural resource recreational services equally provide sustenance and livelihood for social actors serving the needs of tourists. However, the consequences of oil mining threaten the value losses of natural recreational facilities are often relegated issues in policy provide preliminary insights to understanding social-ecological system interactions.

9.3.3 The Governance System Effects

The perception of the governance system design and enforcement is a critical factor in this study because of its application as a proxy indicator for assessing institution effectiveness. For example, despite the dependence on the natural resource system by different social actors at multiple levels and scales, once hydrocarbon is discovered in any geography within the Nigerian territorial sovereignty, the property rights to such ecological system are immediately transferred to the Federal Government in accordance with the Petroleum Industry Act (2021). This practice rooted in the country's constitution has been argued as an alienation of customary rights of local people that pre-existed the integration of southern and northern protectorate that birthed Nigeria (see Chapters 2 and 3). Yet, another historical point of contention that has been corroborated from data analysis result is the additional burden of oil mining externalities in adjoining social-ecological system that the governance system capability and enforcement have not proven to effectively regulate. Unfortunately, this perception of regulatory challenges equally impedes the accruable social-economic opportunities from the natural resource system and contribute to the perceived social vulnerabilities, injustice, distrust for the governance system.

In an oil mining context where the Nigerian Federal Government wholly owned and supported oil corporation, operating across almost all aspects of the oil industry value chain, both as a pseudo-regulator, operator and joint venture partner with other oil companies, it may futile to argue the accountability of governance system enforcement. Besides, this oil corporation provides technical knowledge for designing oil industry regulations for natural resource management. Moreover, it independently and interdependently generates revenue from oil mining activities for the Federal Government in the survey setting. The consequence of this argument is the reported oilfield site that was left burning in a community where social actors source sustenance and livelihoods for several weeks (see Arise News, 2024). This perceived regulatory inconsistency and unaccountability underpin the suggestion of governance system capability and enforcement ineffectiveness that traps other non-oil attributable values to the natural resource system with direct and indirect social-economic complications. This complex finding underscore a central dilemma in the Nigeria's political discourse where the key option for social-ecological system safeguards intersect with political ideological, in corroboration with Bebbington's (2015) linkages of natural resource management problems in Nigeria to political system.

For emphasis, unlike previous SES studies, part of this study objectives is to explore the governance system effectiveness level as a system and entity through which the social-economic outcome of natural resource system extraction at multiple levels and scales is regulated. Whereas, transparent, participatory, and accountable mechanisms in the governance system for the control of oil mining and SES safeguards have been well-defined in the recently revised PIA (2021) with fiscal penalties on oil pollution and gas flaring incidents. However, the attempt at controlling the consequences of oil mining using Pigouvian (Banzhaf, 2020) fiscal mechanisms such as penalties, taxes, subsidies, or compensation without building

and strengthening the capability and effectiveness level of enforcement imposes public cost on the social-ecological system that may be difficult to assess and estimate, depending on the resource value for sustenance and livelihood. From survey data analysis result, although the enforcement of the full accountability costs on oil spillage and gas flaring is meant to disincentivise the consequences of oil mining. However, from field survey evidence immediately after the occurrence of negative consequence of oil mining, the terrestrial, coastal, and marine ecosystem becomes an immediate casualty, which is equally reflected as value losses on the farm and wild crops and fishery harvests, and food production system before the clean-up and remediation exercise are conducted. The perceived ineffective level of the governance system from the research findings, does not only suggest inefficient natural resource management. But that social actors grossly dependent on the natural resource system may be vulnerable to the additional cost of living in their ancestral lands if policy measures are not considered. This perception of governance system enforcement amidst the discovered effects of oil mining stifles sustenance and livelihood sources in the natural resource system as well as constrains its multiple attributed values. Besides, research findings suggest placing more emphasis on enforcing the existing regulation, rather redesigning of the governance system or improving regulatory agencies capacity. This position suggests that the effectiveness of the natural resource management system needs some policy realignment with sustainability thinking to safeguard natural resource system rights and productivity.

With a plurality of social actors, ideologies, values, and economic considerations underlying the institutions designing the governance system, the perceived insensitivity towards value attributed to the natural resource system may be one-sided subjective evidence (see Chapters 2 and 3). For example, just as oil mining impose their externalities on the natural resource system, some reported privileged community social actors' lumbering of

the forest formations and drilling sand from the coastal ecosystems for building materials and firewood equally impose their externalities on the SES (see Chapter 6). This influence of power actors mimicking a rent-seeking mentality (Beblewei and Luciano, 1987), may contribute to the possibility of the river bank collapse and water quality alteration, as well as jeopardise ecologically sensitive breeding grounds for biodiverse fisheries and aquatic species. Likewise, it suggests that whichever social actors generate revenue from the natural resource by imposing their private extraction cost on the SES, such social-economic costs are borne by local communities from nearby these extraction sites. However, beyond the argument of which social actors impose more consequences on the SES, it is the governance system enforcement level responsible for such regulatory gaps that can be suggested as the weakest link and strongest argument for the social-economic crises because of the natural resource value suppression. This aspect of treating unregulated or partially regulated natural resource systems as open access, is the cost it imposes on the SES (see Commoner's dilemma in chapter 3). However, because the consequences of oil mining based on the scale of extraction are often amplified in the nearby communities, these costs on natural resource assets are often not captured as a negative outflow in the proxy dataset applied for GDP assessment. Yet, the debate on the true casual factors driving social-ecological system decline is far from conclusive.

9.3.3.1 Oil Mining Externalities, Governance System and the Compensatory Mechanism

The SES in the survey setting serves as a common-pool natural resource system with a diversity of natural resource units for different social actors. Analysed survey evidence on the consequences of oil mining in the SES influence on household income revealed that 55.7% harvest food crops and fishery products from the natural resource system. Likewise, the perception of household income source decrease for people living in in the SES around

oilfields was 57.2% as against 12.8% that indicated increase (see Chapter 7). Moreover, qualitative data analysis result suggests the additional intrinsic value of the natural resource system which was capture in the questionnaire survey. Yet, the attributable costs to the intrinsic value loss can be difficult to estimate with templated cost-benefit accounting tools for determining compensatory standards (Snyder et al., 2003). Thus, the perceived absence of full-cost accountability for oil mining externalities on the SES could allow for disproportionate assessment of the multidimensional costs of oil mining activities. From research finding, treating the consequences of oil mining as externalities compensated with taxes and subsidies without assessing the length, breadth, and depth explicit and implicit costs on social-ecological system as detailed in Chapters 6 and 7 may merely reflect the oil industry one-sided and centralised governance system perspective interactions with the SES. To bring more clarity to this threat on SES as recently experienced by one leader of a women's group employed in the remediation of Ogoniland reported;

> *"Community people are now saying that it is their right, that when there is a spill, compensation must be paid. They don't want to look at the adverse implication. What they are interested in is the money that should come out of it. So, they allow the spill to continue. And as it is continuing, it is escalating and affecting more areas." And if it is a thing that affects the crop around the area, what they do is that they value the crops and then they pay compensation. So, what we are looking at now is that it should not be delayed compensation; it should be timely so that they don't keep having more spills. And then there is also a need for them to upgrade their (estimation) chart, which they use for analysing spills. I am talking in terms of compensation because it is not fair we are now in a hyperinflated environment or country as it were. And they still use an old list where they say one cassava stem is 200 naira (about 0.096 British Pounds),*

and we know quite well that there is hardly any farmer now in the Niger Delta that does not farm with fertilizer. You use labour, you use fertiliser, you clear the land, you plant, you even buy the stem, and as you are planting, you use labour. And when they do that calculation, how did they come about the figure they are using? People at the end of the day don't even get anything commensurate to what they lost. So, the compensations are never adequate. So, they need to upgrade on whatever they use their criteria for assessing damages so that people too will know that there was value for whatever effort they made before the spill affected them." (ORN10)

This study data analysis result of uncompensated costs or undercompensated losses for oil spill randomness underscores the ineffective level and inefficiency of the collective governance system enforcement of the social, ecological and economic system. Unfortunately, where the SES devastation from the consequences of oil mining becomes irreversible, then the ensuing predictable natural resource system scarcity is capable of trapping social-economic value from the natural resource system.

Another issue of oil spillage clean-up, is not whether or how much provision has been provided for ecosystem remediation and compensation. But the quality of the SES condition that will be bequeathed to future generations for collective sustenance and livelihood. For example, James et al, (2013) citing an earlier UNDP (2006) study disclosed that without extensive consultation and negotiation with local social actors, oil multinational corporations apply a discretionary rate of US$24 per hectare to compensate for their operational externalities on the mangrove ecological system. Meanwhile, a different James et al, (2011) study estimate a potential productivity yield of US$642 per hectare. Besides, despite the identified inconsistencies from comparing different agencies' datasets on crude oil spillage and compensatory fairness in the survey context, the UNDP (2006) estimated a yearly average

of about 240,000 barrels suggestively occurring at 6% in the terrestrial ecosystem, 25% in the coastal ecosystem, and 69% in the offshore marine ecosystem. Yet, Kontovas et al. (2010) estimated that a 1% increase in oil spill size raises ecological system damages by US$0.718 million. Despite the identified extent of oil spillage, some expert interview witnesses report the inaccessibility of oil spill sites in remote and marshy nature of locations, security risks, the intentional under-reporting by operators, or inadequate oversight of regulatory actors (see (see OIE01 and OIE06 in Chapter 6). Thus, aside from previous studies overlooking this evidence, there is also identified data analysis gap in exploring the effects of oil mining externalities. Moreover, qualitative data analysis result suggests a delay in the payment of compensation and instances where no payment is paid at all (see Chapter 6). Yet, 36% of the sampled population indicated that no food palliatives were provided by government during oil spillages that impacts on sustenance and livelihood sources as against 9.6% that indicated receiving food palliatives. This lack of survey evidence richness and analytical depth in understanding the social perception of the magnitude of the natural resource system value trade-off in SES around oilfields and the impact on household income and micro-community economic condition represents one of the key social-economic gaps that this research study has revealed.

In addition, the revised PIA (2021) proposes the Pigouvian externalities fiscal instruments of applying taxes, penalties, compensation, and subsidies to disincentivise oil spillage and gas flaring, despite identifying the ineffectiveness of governance system capability and enforcement from data analysis results. But, applying fiscal measures for penalising oil mining externalities without interrogating the multidimensionality of the natural resource units may continually influence the externalising oil industry's private costs beyond the social-economic capacity of social actors in SES around oilfields. Besides, the full

explicit and implicit costs of oil mining externalities impact on the natural resource system in the survey context may not appear in oil industry natural resource management costs assessments. These non-captured costs suggest that fiscal penalties on the SES depletion may be asymmetric against contextual social actors whose tangible economic or intrinsic value may inadvertently allowed to be degraded. The far-reaching outcome of the ineffectiveness level of governance system capability and enforcement in regulating the asymmetrically attributed values to the natural resource system trade-off suggests the imperceptible costs on social-ecological system identified in this study that may not reflect in the GDP assessment of Nigeria's social-economic performance. It is this perceived lack of capability or unwillingness of the governance system to penalise oil mining externalities in the SES with full accountability, beyond clean-up, remediation, and payment of discounted penalties, taxes, and subsidies that represents a social-economic gap that has been overlooked in interpreting the country's natural resource management challenge.

The key point from the ongoing discourse is that the links between natural resource system values, household income, micro-community economic condition and national economic outcome is the interlinkages between governance system capability and enforcement, oil mining externalities and the social-economic outcome in the national economy. However, without finding the means of defining and translating the extreme choices or abnormal behaviour of some social actor's that influence the persistent externalities on the social-ecological system in the survey setting, the governance system capability and enforcement may remain unpredictable. Thus, translating the governance system challenge into social-economic consequences reflects the disruption of the food production system that equally displaces the community markets that traders patronise from distant locations to source fresh food products. Besides, when community markets are

displaced from immediately selling off fresh food crops and fishery products harvests, the people are likely to suffer post-harvest losses unless counter policy measures are considered. Yet, Collier (2010) underscored the linkages of effective institutions that structure governance systems in natural resource-dependent contexts to economic development. This aligns with the political complexities underlying the convergence of formal and informal institutions and the political power play in the enforcement of the governance system (Oseghae and Suberu, 2005). Besides, this discovery from research finding affirm that informal and formal institutions lacking participatory, transparency and accountability attributes are not necessarily efficient (see chapter 2). But governance system design can be beyond participatory, transparency and accountability attributes, it needs well mediated and defined social contract with collectively acceptable and subscribed rules, strengthened by enforcement capability and stakeholder engagement and enlightenment. This approach may ensure a multilateral bottom-up, cross-cutting and top-to-bottom monitoring and enforcement of operational rule for the collective social-ecological system stewardship and safeguard.

From identifying and discussing the research findings the perceived extreme choices and abnormal of some social actor's contributing to the externalities in the natural resource system mimics the rent-seeking mentality while privileged individual can influence public policy (Luciano and Beblewei, 1987). Yet the permissiveness of this perceived behavioural abnormality could be originating from the governance system that supress other social actor's agitation for natural resource management justice by prioritising oil mining revenue, or underestimating the extensity of oil mining externalities on the social-ecological system. Although, different social actors may find individual coping mechanisms to navigate the income inequality and issue of social justice that can emanate from the disproportionate

social, ecological and economic difficulties from this natural resource system values trade-off. However, the identifiable implications of externalities on the social-ecological system that represent a dense network of historical, social, cultural, natural biodiverse, knowledge and economic enclaves is the threat to different social-economic opportunities from food crops cultivation, fishery products harvest and social-cultural attachment to context.

The challenge of health complications from the consequences of oil mining was also discovered from the data analysis result and research findings. Aside from the direct health concerns reported in the survey (IAN04, ORN07), another respondent reported that:

> "*there is a natural source - the spring water we used to get water to drink is no more…When people are still drinking, that is why the majority of them, if they can tell you the number of people that died, people died on a regular basis because of the incident."* (ORN06)

However, there is another category that is refusing to drink water from the natural spring water source because according to him, "*so that we will not die young"* (ORN05). Thus, considering that these social actors experiencing the consequences of oil mining depend on the perceived contaminated water, air, food crops, and fishery products level, can equally suggests that some of the food products supplied from this SES are likely to contain traces of hydrocarbon contaminants. Yet, contaminants from crude oil spillage or flared gases are can poses varying degrees of health concerns. For example, some interview respondents revealed different social actors reported different experience of health concerns from the consequences of oil mining activities (see IAN08, ORN08, IAN04 in Chapter 6). However, some of this evidence discovered from the field survey corroborates findings by Bruederl and Hodler, (2019) in similar study, with broader implications on physical or mental health issues (Sandifier et al., 2021). Besides, 62.7% of respondents in the survey questionnaire indicated

a decrease in health conditions in the survey setting. This data analysis result on human health complications suggests the social cost of the harmful consequence of oil mining problems. Nevertheless, despite the perception of the health complications from the consequences of oil mining, varying access to healthcare services, or insufficient financial resources among different income groups can impede the sourcing daily sustenance and livelihood needs.

Another group of respondents reported the rigour and cost of lengthy legal proceedings, pursuing legal claims for consequences of oil mining, making communities abandon the available legal opportunities for seeking redress (see Chapter 6). This suggests that social actors without the financial means for the lengthy judicial process are left at the mercy of compensation the regulatory enforcers consider fair and just. As a result, the vulnerable social actors often neglected to internalise these oil mining private costs and nurse either the emotional/physical pains, or depend on palliatives from individuals, oil multinationals, or non-governmental organisations (see chapters 6 and 7). This consequence of the governance system capability and enforcement level reinforce this study argument of suppressing other natural resource system values to the detriment of the broader social-economic outcome. Moreover, the perceived suppression of natural resource system extraction by transferring oil mining organisations' private costs to public costs on social actors and communities near oilfields mimics 'the prisoner dilemma' (Gardner, and Walker, 1994). This perceived counter-intuitive and extreme choices of some social actors' interaction with the natural resource system exemplifies Hardin's (1968) commoner's dilemma of overuse stemming from the lack of rules to prevent self-interest pursuit and resource system collapse. But in this case while the rules are well defined, the rules are not effective enforced in the natural source management approach. Nevertheless, the survey setting mimics the 'tragedy of the commons' theory because of the non-cooperativeness in the social-ecological

system that contribute to the ineffective outcome that can be overcome by an inclusive, participatory, and accountable governance system intervention (Ostrom, 2009; 2012; and 2014). This research findings from this study also reveal the impassive nature of the social actors to their social-ecological system predicament in alignment with Ostrom's (1990) that an appropriate policy response to the social-ecological system dilemma by mobilising stakeholders to devise innovative means of enforcing rules can facilitate efficient natural resource management.

Considering the identified challenges in the SES, the social actors reportedly often expressed their emotions through social agitation and hostilities with the expectation that the governance system enforcement could disincentivise the experienced operational rule infraction in the SES. For example, respondents (ORN04, IAN04 OIE06, IAN09) provide survey evidence suggest different degrees of emotional response to level of perception about the social-cultural attachment, social-ecological system condition and its social-economic outcome (see Chapter 6). Also, by focusing solely on the economic value of nature resource system, governance institutions risk overlooking different deeper social connections with the social-ecological system. Besides, oil mining activities might prioritise short-term economic value, but can destabilise the intrinsic value of social attachment to ancestral habitats. Thus, the decision by each social actor to cooperate with the formal or informal governance system can be contingent on other implicit value of social-ecological system. This suggest that in the surveyed context with interdependent institutions, social actors may be engaged in heuristic process of combining what works until a workable governance system capability and enforcement level is attained. This argument might reflect the often-overlooked dimension of Ostrom (1990) recommendation of polycentric system of governance in natural resource

system governance where informal and form institutions with varying degree of relationships and power ratio can provide operational stewardship for the social-ecological system.

9.3.3.2 Oil Mining Externalities Outcome, Governance System Enforcement and Insecurity Challenges

It is also important to understand how the dilemma of social-ecological system stewardship and social-cultural system dislocation influence social agitations and hostilities that sometimes metamorphose into security crises. As identified from the research findings, social contestations over natural resource system devastation and compensation also generate their conflictual situations and security unpredictability. Community social actors' descriptions of loss of livelihoods to the consequence of oil mining in the SES that impact food crops and fishery products harvest, levels of employment, food inflation, and food poverty, suggest the strongest contributory factor to conflictual issues and security concerns in the survey setting. Notable oil spillages and their externalities were reported in the survey setting as a contributory factor to the landmark 1990s agitations that resulted in the conceptualisation of the Ogoni Bill of Rights that directly challenged the sovereignty of the Nigerian entity (ORN02, Chapter 6 and Martinez Allier, 2014).

The deep-seated perception of social injustice from the growing mistrust arising from the experience from governance system enforcement and social-ecological system condition seems to set local social actors against oil industry regulatory agencies and their joint venture partnering oil corporations. The most notable challenge is the reported wave of hostilities culminating in the militarisation of the regions to protect oil installations (see Chapter 6). This guise of hostilities against the perception of social injustice from governance system and oil mining organisations is suggested to justify the recruitment of youths into breaking pipelines and crude oil syphoning that also influence oil spillages in the SES. For example, a respondent

reported that *"if young people are engaged, one or two if they are empowered all these things, we always fight against some of these crimes, and the society will be peaceful. All the bunkering will not be heard." (ORN05)* Likewise, a different respondent (ORN04) reported that *"a lot of people have actually gone into a lot of crime."* These insecurity crises that often culminate in the disruption of oil mining activities, also overflow individuals and households exploring natural resource system harvest for sustenance, food processing, livelihoods and other social-economic activities. Despite the militarisation of the SES around the oilfields, there are cases of monthly payment of stipends to 'repented' militants previously engaged different forms of criminalities against the oil industry activities to them from inflicting more economic losses on oil mining disruption (see OIE03 in Chapter 6).

On the contrary, the presence of the military in the context is suggested to have contributed to different social, ecological, and economic outcomes, especially concerning crude oil thefts and illegal, unorthodox refining. For example, an expert witness reported:

> *"What I think first of all, if you ask me, the first factor that I will point to is government failure in policy implementation. Now it might sound a bit bogus from the question you asked. The common trend now in the Niger Delta is oil theft. Now in that same environment, there are Joint Task Forces, all manner of paramilitary paraphernalia, and all manner of security officials, with civil defence and police all of them. Yet, the activities are still thriving even in the presence." (OIE03)*

Also, BBN03 suggests that "*and because there are government agencies that are collaborators to the crimes."* With this new evidence alluding to the connivance of the security forces drafted to protect lives and oil installations, the insecurity experienced in the survey setting cannot be attributed only to the consequence of oil mining activities. Rather, the evidence suggests that insecurity may also be attributed to the ineffectiveness level of governance

system enforcement to hold social actors impacting social-ecological system condition negatively.

While the reported subjective perceptive from qualitative data analysis findings are revealing, statistical result provides an objective perspective to the security crisis. For example, this statistical analysis of evidence identified a significant relationship between security conditions and household income sources (see Chapter 7). The finding suggests that variations in the security situation are associated with differences in household income sources, potentially reflecting how the perceptions and experiences with security influences economic outcome. Besides, the respondent reported that:

> *"So, at the end of the day, even oil activities become very expensive because if you go to these companies together, there are heavy security organisations. You have a general manager, security. Security now has become one big department, and it is eaten deeply into the budget of oil and gas activities in the Niger Delta. You will discover that the cost of production of a barrel of crude oil has become very expensive. Due to the money that is expended on keeping the security of the organisation." (OIE06)*

Likewise, the insecurity crises have been traced to natural resource system degradation and food cultivation challenges often culminating in social-economic paralysis (ORN01). Aside from the annual publication of the direct costs of insecurity in the oil mining communities, there are other indirect costs accompanying the oil pollution crises. Besides, Newsom (2011) underscored the unplanned security cost imposed on extra oil and gas production in the oil industry was more than $160 million per year. Therefore, while research findings suggest linkages between the social perception of insecurity from oil pollution consequences in the survey setting, new data analysis evidence reveals a relationship with the social-ecological

system with broader implications on social-economic outcome that is beyond existing knowledge about the research problem.

The crucial element identified complications emanating from the research finding on the effectiveness level of governance system capability and enforcement is the suggestion that natural resource system management need to move beyond the existing models of regulations for sustainability framework. For example, Ostrom (1990) considered the Searle's (1995) 'collective intentionality' as a key element of institutional facts that requires shared beliefs amongst social actors by acknowledging the sanction for unacceptable behaviour in the survey setting (Lewis, 2023). Thus, in a participatory and accountable mechanism, no individual social actors can unilaterally declare and enforce any particular social rule within the survey setting, without recourse to appropriate sanctions agreed by social actors. Nevertheless, social actors in a shared relationship assigned with social-ecological system stewardship responsibilities as institutional prescriptions needs to be strengthened and empowered as a supplementary layer to the existing ineffective governance system.

9.3.4 The Economic Effects and Social-Economic Outcome

The extensity of the interrelationships between SES condition, governance system capability and enforcement and social-economic outcome may hardly be understood in GDP economic performance assessment. However, statistical results indicate that perceptions about the changes in the quantity and quality of farm crop harvests, fisheries, and seafood are related to changes in household income sources and micro-community economic condition. Likewise, as the quality of water sources, plants, forests, and wildlife changes, the household income sources tend to change in related direction (see Chapter 7). Thus, these research findings reveal household income and the local community economic condition levels are generally structured around the social-ecological system safeguard. This perception of the economic

effects reveals the direct and indirect costs of the consequences of oil mining activities on the social-ecological system as well as the cycles of unpredictability for farmers or fishers who are unable to cultivate their farmlands or fish until the ecological system is restored to its original condition. Besides the intrinsic value based on social-cultural attachment, either for traditional knowledge, medicinal plants, religious worship, local cuisines, or recreation activities can be difficult to estimate in monetary value.

Despite the dependence on social perception for the economic effects of oil mining activities, research findings suggest a harsh condition for a social-ecological system that provides habitat for biodiverse plant and animal species with broader implications for the food production system, human health, and livelihoods. Statistical results from field survey evidence confirmed a relationship between the diversity of natural resource units and economic outcomes. This result is corroborated by qualitative evidence as reported by one of the respondents that;

> *“The pipelines were beginning to fail, and the oil that was sipping from the pipelines, they did not just contaminate the water bodies; they moved as far as going to land, entered people's farms. And a lot of things were lost. Crops were lost, and fish began to die. There was no food to eat. They did not know how bad it was. So, because of hunger and starvation, some people still eat that contaminated produce, because that was what they had available at that time, while some did not even get anything for themselves to eat." (ORN04)*

The food crops cultivation and fishery products harvests, as vital aspect of the sustenance and livelihoods source, provides food supply, post-harvest processing, nutrition and trading services that often engage women and youths with fewer opportunities. Likewise, the food production activities provide employment and income to other ancillary businesses supplying

farm tools and fishery equipment construction, sales, leasing, and maintenance (see Chapter 6). Yet, aside from local households, employees of the oil industry are equally beneficiaries of food crops, fishery and seafood harvest and processing that support domestic household food and nutrient supplements and oil corporations catering services for their workforce. This suggest that the natural biodiversity in the survey setting links the social attributed values in the survey setting to emphasise the interdependency between the social, ecological and economic system. Thus, the trade-off of prioritising oil mining activities with all its consequences generates a vulnerable economic effect for all dependent social actors in the present time and in the near future. Accordingly, no singular social actor either in the survey setting or other contexts dependent on its natural resource system values is excludable from the consequences of oil mining activities impact on the social-ecological system. The research finding can be important in developing governance system to organise, mobilise and invest in social-ecological system stewardship that incentivise residents, indigenous social actors and the broader social-economic system.

Meanwhile, oil and gas production activities are mostly known for their preference for specialised skilled employees, which is lacking among the available workforce in nearby communities where oil activities are domiciled. For example, as reported in the survey exercise, the categories of jobs available to residents adjoining oil fields are often non-skilled low-cadre jobs created either on short-term contract jobs with low-wage workers as report by IAN04 (see Chapter 6). But, when community youths are trained, such vacancies are not readily available, even though the alternative natural resource system serving as the most sustainable source of employment are reported to be degraded from the consequences of oil mining activities (ORN10 see Chapter 6). Unfortunately, unemployment is prominent among current difficult problems in the setting, supported by a 33.3% unemployment rate (NBS,

2020). Yet an estimated 70% local population are estimated to engaged in different categories of the agricultural sector for employment (FAO, 2022). Yet, the unemployment rate in Nigeria is estimated at 33.3 per cent (representing 23.18 million people) in the fourth quarter of 2020 (NBS, 2021). The economic effect of the reported scale of unemployment can impact on household's income and micro-community economic condition that can contribute to increase in dependency on the social-ecological system. Likewise, as the unemployment rate increases, different households are likely to be unable to afford and access sufficient food and, exposed to the problem of food poverty.

Food poverty in this study suggests the inability of the social actors to employ their collective skillsets to produce food or generate livelihoods to buy food crops for sustenance. However, this food crops cultivation difficulty is capable of imposing food shortages challenges. For example, some women traders in Ibeno were reported to travel to Ogoja (a distance of 300 kilometres) to procure food products for resale in local community markets (IAN04). The current food inflation estimate in Nigeria is 39% (NBS, 2024). However, aside from the direct consequence of oil mining activities on the natural resource system, there is the indirect security concern and its destabilising tendency on the SES for food cultivation and fishing activities engagement. This experiences of unpredictability of social-ecological system context amidst the reported social-economic complications, have been identified to mostly contribute to food shortages and food poverty (see also Dasgupta and Maler, 1995). However, employees of the oil industry living the survey setting are more likely to afford food crops irrespective of the cost because of the predictability of their monthly income. Unfortunately, the vulnerable social actors grossly dependent on the natural resource system, whose purchasing power is often constrained by the consequences of oil mining activities, are left with fewer social-economic alternatives. For example, one of the respondents reported that;

"the most difficult problem I see in my community right now is poverty. Why I mention poverty is because those who don't have white-collar jobs and depend on the environment to survive, they are no longer able to achieve anything. So, as a result of this, poverty and hunger are one of the challenges out of many." (ORN06)

It is this type of reported unemployment or underemployment arising from SES breakdown that contributes to the inability of some social categories to afford basic life necessities. This suggest that different social actors are left to seek coping mechanisms for food scarcity to the perceived prevalence of food poverty in the context. Thus, if the economic effects in social-ecological system around oilfields is viewed from the prism of natural resource system values contribution to house income and micro-community economic condition, then the inability to safeguard a healthy, sustainable, and inclusive context for entrepreneurial farming, fishing and food processing may explicate the fundamental factor influencing its social-economic outcome. Accordingly, the overflow and repercussions of the changes in household's income and micro-community economic condition in SES around oilfields suggest the explicit and implicit linkages to the national economic problems.

9.4 Chapter Summary

This chapter by discussing data analysis results, findings and interpretation from Chapters 6, 7 and 8, identifies the interrelationship between informal and formal institutions on the outcome of governance system design, capability and enforcement in the social-ecological system around oilfields. Likewise, applying governance system capability and enforcement as a theoretical argument for assessing the effectiveness of institutions in natural resource management; data analysis result and findings revealed that aside from the appropriation of oil revenue contribution to social-economic development, other natural resources system values that supplies freshwater, cultivated and wild food crops, fishery

products and support employment for household income and micro-community economic condition level are either alienated, overlooked or suppressed for oil mining activities. This prioritisation of oil mining suggests a resource trade-off that are often not reflected in current Nigerian economic performance assessment data. In a natural resource system where the processes that shape the evolutions of its biodiversity are often silent and invisible, the dominant governance system external to the context should not be expected to effectively enforce regulatory for social-ecological system safeguard. Accordingly, unless social interdependencies broadly and deeply contemplate and accountably map the stewardship based on their collective aspiration, the natural resource extraction interaction that impacts the social-ecological system may persist. While the influence of governance system capability and effectiveness on these natural resource system depletion crises cannot be outrightly downplayed, its undeniable practical economic effects that overflow to other social-economic systems may underpin its usefulness. The perceived governance system unpredictability emanating from the structural foundations overlapping the historical, social-cultural, political, institutional, ecological, and economic considerations suggest that the sovereign State of has not completely weaned itself from its colonial legacies. This is symptomised the dilemma of competitive nature of property rights system in a polycentric system with unbalanced power ratio that are unable to agree and enforce social-ecological system safeguard for social-economic progress. Reflecting these categories of social actors' interactions with social-ecological system, the perceived consequences of oil mining and the social-economic outcome suggests the importance of this study filling the knowledge gap on the Nigerian social-economic problems that is generalisable to other similar natural resource-dependent contexts.

Chapter 10

Conclusion

10.1 Introduction

This research aims to contribute to understanding the Nigerian economic problem from the SES perspective analyse the often-overlooked evidence about the research problem. The following objectives helped in achieving the research aim:

1. To understand the relationships between oil mining activities and other natural resource system values around the oilfields for explaining Nigeria's social-economic problem.
2. To explore the historical and social-political foundations that have shaped the evolution and structure of natural resource management institutions in Nigeria.
3. To explore how the effectiveness of natural resource management institutions linkages to social-economic outcome can be evaluated from the perspective of the social-ecological systems around oilfields.
4. To conceptualise and design a context-specific theoretical framework for investigating institution capability and enforcement on natural resource system values and its impact on social-economic systems in the social-ecological system around oilfields.
5. Building on research objectives 2, 3 and 4, to design and apply a purposive mixed-methods diagnostic framework for collecting three layers of field survey evidence to connects the research problem with research findings.
6. To reinforce the achievement of objective 5, qualitatively analyse the survey interview evidence to interpret social-economic outcomes and generate insight for designing the survey questionnaire (Objective 6).
7. Conduct a quantitative analysis of survey questionnaire evidence to generate results and findings for meeting Objective 6, as a preliminary understanding of the research problem.

8. To complete Objective 5, integrate and compare the data analysis results and findings from both phases of data analysis to comprehensively explicate relationships between the natural resource management and the social-economic problem.

10.2 Response to Research Objectives

10.2.1 To review literature on institutional theory to understand the historical and social-political foundations that have shaped the evolution and structure of natural resource management institution in Nigeria. (Objective 2)

The Chapter 2 theoretically explores the institution theory, defines institutions and explains the classification of institutions, their interdependency and influence to social-economic outcomes. Then, the study briefly reviews the historical background underpinning informal institutional evolution in Nigeria, explaining how colonial legacies' integration of precolonial informal institutions eclipsed unique norms, ideologies, beliefs and geographical demarcation to influence institutional structuring for natural resource management. Also, the chapter explores literature for insights on how the influence of colonial legacies impacted the restructuring of post-independence institutions and natural resource governance system design. The unpredictability of informal and formal institutions in natural resource management in the survey setting is suggest to explicate pattern of historical and social-political arrangement influence on natural resource management institutions that has not completely detached itself for its colonial legacies. Thus, in response to Objective 2, Chapter 2 provides historical knowledge on factors that underpin informal and formal institutions' structuring for natural resource management institutions in Nigeria.

10.2.2 To explore how the social-economic outcome interlinking natural resource management institutions can be evaluated in the social-ecological system around oilfields (Objective 3).

From exploring how informal and formal institutions influence natural resource governance system design, capability and enforcement around oilfields. This study argues that the deviation of informal and formal institutions' normative expectations in natural resource system management from the contextual realities is an important factor for testing effective institutions. Then the study explored the linkage of effective institution to social-economic outcome, and proposed to test the effectiveness of institutions that evolve from Nigeria's unique social-political arrangements with divergency social-cultural ideologies by aligning the effectiveness level of governance system capability and enforcement around oilfields as variable. Chapter 3 theoretically explores the peculiarity of Ostrom's Institution Agency and Development (IAD) framework (2007) and McGinnis and Ostrom's (2014) the social-ecological system theory for building a theoretical framework for exploring the research problem, and justified the adoption of the social-ecological system framework for this thesis.

10.3 Contribution to Knowledge

10.3.1 To conceptualise and design a context-specific theoretical framework for investigating the sources of sustenance and livelihood in the social-ecological system around oilfields (Objective 4).

The foundational SES framework is limited in its ability for exploring the complex economic problem emanating from the interactions within social-ecological system contexts especially in a context disproportionate competing property rights that prioritises economic variables. From justifying the appropriateness of the SES for examining the research

phenomenon, thesis revised the SESF framework for a context-specific study and provided a step-by-step guideline for mapping the SESF first-tier variable linkages to the second-tier variables and survey indicators. Also, the study identified, considered and selected more indicators for tracking the variables towards operationalising the revised SESF framework for the field survey exercise. Then the study explored the compatibility between the social-ecological system theory and pragmatist instrumentalism philosophy to guide the design of a sequential mixed-methods diagnostic framework for gathering real-life experience evidence around the oilfield geography. Besides, the theoretical design of a practical guideline for operationalising the SESF rises beyond the limitations outlined by Hinkel et al, (2014), Epstein et al. (2013), Marshall, (2015) and Partelow (2018) by transparently applying the framework to generate survey evidence in the setting (see Chapter 4). An important contribution to theory as at the time of submitting this thesis, to the best of the researcher's knowledge there is no known study at a PhD scale that has applied the SESF to explore an expansive and complex national social-economic phenomenon in natural resource-dependent context, where oil and non-oil related natural resource values extraction compete concurrently the social-ecological system.

Additionally, applying McGinnis and Ostrom's (2014) Social-Ecological System theory from the foundational common-pool resource problem to explore social-economic research problem agrees with Bots et al, (2015) stance that the SES theory is theory-neutral. However, the conceptualisation, application and operationalisation in this thesis extended beyond the SESF capabilities by adapting it to examine complex interaction outcome in natural resource-dependent contexts with unique geographical characteristics and human-made infrastructures. By the aim of this study, aside from applying the SES framework to diagnose interaction and ecological system disturbance problem in the Niger-Delta common-pool

resource system, the selection of new subsystem variables to examine a context-specific social-economic problem, natural resource management sustainability reinforces the testing of the flexibility of the theory. Besides, the revision of some variables to specifically characterise and monitor evidence at the micro-levels of individuals, households, and communities' interactions level to explicate the research problem serves as a preliminary step toward building a theoretical framework for future studies consideration when exploring, while promoting sustainability sciences through deeper and broader variables for social-ecological system condition. However, applying the theory for context-specific studies may limit the generalisability of the identified social, ecological, governance, and economic impacts in this study to other settings due to system and subsystem. Nevertheless, the structural rigour and systematisation approach to this social-ecological system study provide a dependable and transferable guideline for operationalising the framework. Moreover, the deep, rich and broad survey evidence within social-ecological systems, highlighting the competing property rights held by different social actors, power hierarchies in the extraction of natural resources, and the resulting social-economic outcomes may suggest a similar pattern in context with ineffective institutions. Besides, the depth and richness of human choices and actions in the environmental process revealing the consequences of oil mining activities on ecological system disturbance can foster collaboration between social and natural sciences for a transdisciplinary or interdisciplinary study.

In contributing to knowledge, this thesis build on over a decade of published peer reviewed research and development on the SES framework from Ostrom's (2007, 2009), Cox's 2011, McGinnis and Ostrom's (2014), Epstein et al (2013), Hinkel et al, (2014), Bots et al, (2015), Vogts et al 2015), McGinnis 2016, Partelow (2018, 2019) and Nagel and Partelow (2022), to affirm that the SES framework remains a versatile and robust tool that can benefit

from integrating social, ecological and economic concepts in an interdisciplinary study. Therefore, aside from narrowing the SES framework gap by integrating preliminary third-tier variables to demonstrate how important economic concepts can be integrated, this study also illustrates that through structured synthesis, the SES framework is amenable for social-economic problem study. However, much work remains before it can provide a foundation for social-economic analysis in natural resource-dependent context. Accordingly, in response to Objectives 3 and 4, this study justifies its empirical usefulness and exhaustiveness of SESF testing the effective institution linkages to social-economic outcomes.

10.3.2 Contribution to Methodology

10.3.2.1Building on research Objectives 2, 3, and 4, to design a purposive mixed methodology diagnostic framework for collecting three layers of field survey evidence that demonstrate a clear connection between the research objectives and findings (Objective 4).

Guided by the compatibility between the social-ecological system theory and pragmatist instrumentalism philosophy, this thesis designs a research strategy using the transformative sequential mixed-methods approach to collect multiple human real-life experiences evidence in the survey setting. Thus, this methodological pragmatism that supported the flexibility of selecting and administering three survey instruments to collect evidence from the social-ecological system around oilfields, challenges the traditional philosophical scepticism about the effectiveness pragmatism for studying complex social-ecological system problem. This approach justifies Kuhn's (1963) submission that pragmatism belongs to the extraordinary inquiry that creates scientific revolutions beyond the limits of traditional science. Also, the study applied a unique sequential mixed-methods data analysis framework that combines thematic analysis to process semi-structured interview evidence and statistical analysis to analyse survey questionnaire evidence in response to Objectives 5

and 6 (see Chapters 5 and 6). Accordingly, this study purposively designed a code dictionary (see Appendix 3) to code field survey evidence, revealing exhaustive results underpinned by the respondent's verbatim perceptions across different communities near oilfields in three sub-nation states in the Niger Delta (see Appendices 11). Additionally, the insights from the qualitative thematic analysis are applied to design the survey questionnaires segment of field survey. Furthermore, thematic analysis results guide the design of unique visual maps interconnecting the multiple level and scales of social-ecological system interaction and social-economic outcomes the oil mining context (see Chapter 6). Qualitative and quantitative data analysis results and interpretations are applied in generating complementary and confirmatory findings that bring comprehensive knowledge to the research problem from a new perspective. This richness and broadness of the research findings justifies the mixed-methods approach for understanding of this complex SES interaction around oilfields.

10.3.3 Contribution to Practice

The primary aim of the study is to understand the social-economic problems of the Nigerian social-economic phenomenon from the SES perspective. This study generates unique real-life human experience-based evidence of the interdependency between informal and formal institutions regulating social-ecological system interactions around oilfields at the multiple levels and scales. This primary evidence and data analysis result underpinning context-specific findings contribute to the ongoing discussion on the interrelating social, ecological and economic effects of natural resource system management on households, communities and national economic outcomes around oilfields. Insight from these research findings suggests that despite the recently revised Petroleum Industry Act (2021), primary evidence of the randomness of externalities from oil mining activities that imposes public cost on the social-ecological system was discovered in this study to be contributing to the

conflictual situations and security concerns in the context. This analysis identified multiple ineffectiveness of governance system capability and enforcement challenge, raising the question of what type of institutional capability and enforcement is more sustainable, useful, practicable, or even equitable in a complex social, ecological and economic geography. The research and data analysis results of this study therefore underscore the need for a broader approach to participation, accountability, and monitoring how social-ecological systems interact within the larger nested social, ecological, and economic systems. This process involves developing indicators based on natural resource valuation, with key considerations on which features of the natural resource system are valuable to each social actor, where and how to extract them, the transformation processes involved, and the consequences of extraction on the livelihoods of each stakeholder.

The assessment widely reported by respondent to this study outline ineffective governance system capability and enforcement. This ineffectiveness is rooted in the perceptions reported by respondents in the survey setting. For example, the reported security concerns including militarization of the oil installations, were linked to a broader impact on the social-ecological systems, and the increased social-economic vulnerabilities reported by indigenous and resident social actors and this provides valuable insights to policy actors. The research conducted from this thesis captures knowledge on how social actors establish institutions for managing natural resources systems, the social relationship dynamics, the enforcement of property rights, and provide stewardship for the social-ecological system safeguard. These could apply as guidelines for within local communities, intercommunity's and community with external social actor's stakeholder engagement. Accordingly, this research has demonstrated that policy actors and stakeholders are equipped with evidence-based knowledge to collaboratively reassess, reorganise, and create a more transparent,

participatory, and accountable governance systems for peaceful co-existence and shared social-economic progress.

10.4 Directions for Future Research

This interdisciplinary theoretical framework provides primary evidence-based research results and findings that connect the research problem, aim, and objectives. The study identified several empirical gaps that could warrant further investigation, although they were beyond the scope of this research. Additionally, the highlighted limitations encountered during the study that could not be further explored but more inspire more empirical debates and discussions about the social-economic outcome in natural resource-dependent contexts. Future studies could consider the following areas:

- Investigating how colonial legacies have suppressed customary rights and their impact on the evolution of formal institutions' approaches to natural resource management.
- Introducing new empirical perspectives on the challenges of balancing natural resource system values in a centralized governance system that regulates a common-pool social-ecological system.
- Examining the effects of unregulated groundwater withdrawal for domestic and industrial use on future water scarcity in rural communities in social-ecological systems around oilfields experiencing freshwater contamination challenges.
- Exploring how emotional responses to social-ecological system degradation lead to unacknowledged mental health challenges around oilfields relying on natural resource extraction.
- Assessing the adequacy of Pigouvian taxes and compensatory schemes in reflecting the intrinsic value attributed to social-ecological systems in oil mining contexts.
- Developing a mixed-methods analytical framework that combines qualitative and

- quantitative approaches to investigate socio-economic outcomes in social-ecological systems, testing the validity of this study's diagnostic framework.
- Providing empirical guidelines for research aimed at collecting gender-based survey evidence.

10.5 Finding Unexpected Evidence

This interdisciplinary research aimed to discover representative evidence from the social-ecological system in the fringes of three communities around oilfields. However, the most surprising findings from this study reinforced some theoretical arguments presented in chapters 2 and 3. For example, data analysis evidence revealed that some self-interested leaders were engaging with regulatory and oil-mining social actors in survey context at the expense of their collective interest groups and informal institutions. In addition to the commonly perceived impact of oil mining consequences, study findings reveal the multiple levels and scale of the mangrove forest logging, alluvial sand mining, earth surface vibration, and the presence of harmful substances such as Benzene and Mercury in both freshwater and coastal ecosystems. These findings highlight the intensity of human interactions (either at a small or industrial scale) with the social-ecological system, providing new insights to the researcher. Moreover, there were reports of some social actors in some Ibeno communities who suffered loss of life and property to ocean surge. Additionally, unexpected incidences of sea encroachment in the Twon Brass kingdom were reported. Another unforeseen finding was the scale of criminalities, which included groups breaking pipelines to steal and illegally refine crude oil, along with the abandonment of leaking pipelines that allowed freely flowing crude oil to contaminate the ecological system. Despite the findings on reported disruption to the social-ecological system disturbance, the average weekly income from fishing was surprisingly still higher than the monthly minimum wage of N30,000 (approximately 17 British

pounds) in the Nigerian Civil Service. Nevertheless, income from fishing was reported for survey evidence to depend on other weather and social factors.

10.6 Reflexivity in this Interdisciplinary Research Process

The Nigerian social-economic phenomenon has been problematised, theorised, studied, and interpreted for this study from the social-ecological system perspective around the oilfields. The choice of exploring this research problem is born out of understanding how a natural resource system bestowed with biodiversity has historically been embroiled in different forms of social, ecological, and economic complications. My perspective of exploring this perceived multidimensional problem is to humanise the effects of the extraction of natural resource from the social-ecological system. This survey geography is widely known to contain biodiversity species encompassing everything from genes to entire ecological systems, including the aspect of lives that may not have been scientifically described or inestimable. It is for this reason that this study proposed to examine human real-life experiences from social-ecological system interactions, the attributable value to the natural resource system, and the regulatory effects of social actors' concurrent extraction. Thus, understanding the different ways social actors independently and distinctively contribute to its social-economic outcomes.

My PhD research is influenced by my experience working around oilfields, visiting communities, and engaging with people living near oilfields. Also, reading different publications on the oil mining consequences on the ecological system around the Niger Delta context and reviewing the social-economic statistics of people living in the contexts partly influence the desire to examine oil mining impact on the social-ecological system, and its spill over to the national social-economic outcome. This decision suggests, I feel motivated by my experience and was biased towards the perceived vulnerability of people, income inequality

and the concern for social justice of people and communities near oilfields, their ecological system, and the resilience of their livelihood sources. Besides, no country should be too prosperous, to overlook the vulnerability of natural resource system to human actions, or expect to sustain its social-economic wealth without converging its political, social, ecological and economic thinking. Nevertheless, this experience raises the epistemic dilemmas to provide a more comprehensive knowledge that challenge the interpretation of previous studies on the Nigerian social-economic phenomenon. For example, despite the perceived mismanagement of revenue from oil resource extraction (see Chapter 1), there is the customary rights and the issue of the sustenance and livelihood sources for an estimated 28.8 million people engaged in farming, fishing, petty trading, day labour, and paid-employment occupations that are grossly dependent on the natural resource system in the context. Yet, their rural subsistence lifestyle dependent on the natural resource system that can be difficult to capture by GDP metrics because it is often-non-cash-based. This challenge suggested knowledge a whole economic system that might be possibly detached from formal economic systems. But, this study can miss the research aim that converges the social, ecological and economic questions to understand the social-economic problem of a natural resource-dependent context, despite well-designed governance system with building a robust theoretical scaffolding.

To collect representative evidence, I considered the ontological pragmatism that permits the interrogation of people's real-life experiences within the survey context. This philosophical standpoint was foundational in guiding how the knowledge generation about the research problem was constructed, with findings grounded in robust theoretical framework and empirical evidence. Thus, the broadness of the social-ecological system theory and the flexibility permitted the study to consider and revise second- and third-tier

variables for the field survey. Nevertheless, my judgements towards determining and selecting SESF variable indicators to guide the field survey exercise and navigating some of the field survey limitations during the administering of survey questions guided the application of an expansive framework that was broad enough to capture an interdisciplinary dimension, but deep enough to give a voice to each survey respondent to share their perception about the research problem. Although the application of the theoretical framework was within the researcher's empirical capacity, experience, and supervisory guidance, nevertheless, a number of challenges were experienced before, during and after the field exercises. For example, the adoption of remote data collection and administered survey instruments was influenced by COVID-19 restrictions, meaning that the researcher had no physical contact with the respondents, suggesting minimal physical influence on how the survey respondents answered the interview questions and questionnaire. Yet, surveying respondents' experienced communication barrier of respondents who could not communicate properly with English Language. These challenges meant that the researcher had to make personal judgement on how to navigate field survey limitations which could result in subjective judgements. All the same, despite designing and operationalising the research strategy, the field survey evidence was representative of the survey respondents' perception, as co-creators of knowledge.

The thematic qualitative data analysis generated themes using the SESF variables provided the structure for reporting results. However, the data analysis process of predefining and designing a code dictionary, audio interview transcription, interviews, and survey evidence data clean-up contains some personal judgement about what was most empirically acceptable and feasible to generate trustworthy results. For example, the code dictionary design grouped codes into clusters around similar and interrelated subjects guided

before categorisation that generated themes across the entire dataset. Also, comparing and contrasting evidence across and within each respondent's case was to accord equal weight to each respondent's evidence before discussing emergent code to clarify themes (see Appendices 3 and 11). Although, no evidence from any single respondent was overlooked during the data coding exercise. But because the survey interview evidence was voluminous. Yet, through the thesis write-up process, the researcher iteratively and carefully crosschecked the interview transcript for important evidence, whilst considering the research scope and in doing so filtered the less significant material in order to focus on the most important evidence. Besides, after exploring the nuances of the evidence, data analysis results were reviewed to identify the representation respondent of perspectives.

Another way of controlling subjectivity in the qualitative analysis was to explicitly extract its multiple perspectives to support themes so as to prevent the over-dependence on the voice of any singular respondents. Also, emphasis was focused on reflecting respondents' evidence relating to specific incidents to signpost data analysis results. Nevertheless, the code dictionary and categorisation represent the social-ecological system framework, research objectives, and findings, because although the survey evidence representing subjective human perception belongs to the survey respondents, the systematised process and rigour of data analysis for generating results and research findings support my research efforts as a facilitator of the knowledge. Additionally, to be convinced of the plausibility and objectivity of the data analysis research result and findings, I further hypothesised some of the survey questions to test questionnaire evidence for a relationship using Spearman correlation in the quantitative analysis segment. Although, the inferential statistical analysis was beyond the initially research strategy, the statistical significance of the results provided me with more confident that the data analysis result and findings will achieve external validity. Thus, all

through the data analysis process, I have attempted to control the different forms of perceived subjectivities by applying objective statistical analysis to achieve credibility and dependability of results. Likewise, by transparently reporting empirical judgements, acknowledging the different forms of limitations, I believe that the research findings alignment with the survey evidence speak for itself. Unfortunately, it was difficult connecting a social-ecological system complication to an economic outcome at the beginning. But, as I introspect on the epistemological process of collecting survey exercise and data analysis, though systematic with empirical rigour, I am satisfied of the research outcome.

As I submit the final thesis, a number of questions have arisen for me: were the survey instruments systematically applied? Does the field survey exercise reflect empirical rigour? Is the evidence gathered or data analysis results relevant to the research objectives? Is the evidence gathered or data analysis results different from existing literature on the research problem? What is the relevance of the research findings to policy actions? What further research problems have been discovered from the data analysis and discussion of findings? To me, considering the rigour and systemisation of the process I have the easy answers. However, to others I do not think that the answers to these questions should be binary until the entire study has been read and digested from the social-ecological system around oilfield perspective. Otherwise the answers may be merely simplified without considering the different research decisions and subjectivities needed to generate the study outcome. For example, to capture the daily and weekly income estimates from natural resource system livelihoods, I observed challenges of collecting survey evidence from informal fishing trade because the fishers or traders lack the exact daily records of their income and expenses because of the other factors such as season of year, weather, the scale of operations and other social considerations associated with their trade. This challenge meant estimate

provided in the data analysis were much more for many fishing individuals and households. Thus, the income level range of fishers or farmer could not be tested in the survey questionnaire segment to achieve the trustworthiness of the result. Besides, the questionnaire respondents are external to the local communities where the fishing activities are conducted. This suggests that there could be other non-explored questions that could have provided deeper insight into the analysis. Despite the survey challenges and limitations experienced, I am satisfied that the generated survey evidence, data analysis results, and research findings that framed the discussion followed a systematised scientific procedure as proposed in the research.

It is my belief that this qualitative mixed-methods approach study that applied the McGinnis and Ostrom's (2014) SES theory to innovate a purposive diagnostic framework can serve as an empirical grounding for future studies to consider when studying natural resource-dependent contexts with possible refinement. Fortunately, my experience in seeking collaboration with appropriate scientific and non-scientific channels during the field survey exercise and analysis suggests teamwork that transparently contributes to balancing my subjectivity with objectivity for dependable and transferable results and findings. In synthesising this knowledge, my empirical skills in problematising the research phenomenon, asking critical questions, operationalising the research framework, and making insightful judgement to navigate limitations are better developed. Other skill sets that I seem to have mastered better are critical reasoning, writing, communication skills, field survey exercise, actively listening, mixed-methods data analysis, following standardised guidelines, identifying the role of project supervision, being responsive and willing to retrace mistakes, and recognising and adhering to stipulated timelines. It is difficult not to imagine whether lessons learnt during research study may not translate to policy actions if academic science focus on

traditional epistemology choose to overlook the practical knowledge for social-economic improvement generated from a well-defined and applied pragmatist's standpoint.

Expectedly, the experiences and knowledge from this study will be useful beyond the PhD exercise to new prospects where these new skills may be useful. In an epistemic modesty and honesty, I sign off as a PhD researcher to the next phase knowing that irrespective of my bias, I brought to this research exercise an unwavering mental discipline to stay positive and objective irrespective of my personal subjectivity. Thus, submitting this PhD on social-ecological system analysis of social-economic outcomes in natural resource-dependent contexts marks my modest imprint in empirical science. Nevertheless, I remain open-minded to new experiences and knowledge that might require interacting across disciplinary boundaries and engaging in scientific studies on social, environmental, and economic geography, agriculture, social justice, and sustainability science.

10.7 Limitations

To establish the relevance and validity of its research findings, this study acknowledges the limitations inherent in the research process, covering theoretical, conceptual, methodological, contextual, and the researcher's capability.

10.7.1 Theoretical Framework Limitations

The SES framework comprises seven first-tier variables, each associated with an average of four additional second-tier and third-tier variables. This broad theoretical framework makes its operationalization a complex task. Consequently, theorizing, adapting, mapping, and defining adaptive variables across different tiers, as well as selecting indicators to capture field survey evidence, can be cumbersome for an early career researcher lacking in-depth knowledge. Moreover, applying the SES framework to address a specific research problem may necessitate revisions to the second-tier and third-tier variables and the

identification of indicators that most accurately represent aspects of the research problem to collect data on. Besides, adjusting the mapping of the SES framework and modifying some second-tier variables can impact the time, cost, and outcomes of a PhD research, especially one with stringent timelines. This challenge can also jeopardize the PhD research without comprehensive supervisory guidance during and after the field survey and data analysis. Therefore, applying the SES theory implies that researchers must possess a nuanced understanding and deeply reflect on empirical judgments during the operationalization of the framework. This limitation indicates that applying the SES framework in this PhD research, which integrates natural resource endowment, informal and formal institutions, and governance system design, capability and enforcement, should carefully examine the social-economic outcomes from the perspectives of individuals, households, micro-communities, and how it overflows to the national economy.

10.7.2 Methods Limitations

Understandably, this research, because of its context, scope, generated expansive field evidence from which findings were developed may inevitably have some blind spots associated with the application of mixed-methods for field survey exercise. For example, to prevent exceeding the study scope, some evidence generated from the interview sessions could not be tested in the questionnaire survey. Besides, by applying a qualitative mixed-methods approach to data gathering and analysis on human experiences, this study cannot deny the elements of bias of survey respondent. Additionally, the inability of some respondents to communicate in English language posed a communication barrier that required translating survey question to their language of understanding. Also, because the sequential data collection focused on corroborating and confirming insights from semi-

structured interviews with survey questionnaire, this research strategy could limit the possibility of generating broader evidence in the quantitative segment beyond the evidence gathered from the qualitative segment. Nonetheless, the study generated and analysed survey evidence to enrich and deepen the research findings, justifying the exhaustiveness of sequential mixed-methods for knowledge development.

10.7.3 Survey and Survey Setting Limitations

Survey questionnaire were administered remotely via an online platform. The online platform had an operational glitch that made the survey questionnaire inaccessible for a full day (see Appendices 7 and 8). The downtime experienced from the online survey platform implies that the effectiveness of survey questionnaire administration was dependent on the technology capacity of the platform owners. Also, the survey contexts experiencing public infrastructural challenge meant that the field survey exercise was exposed to limitations of electricity power availability to respondents' mobile devices and internet technology. Besides, everyone that had interest in participating in the survey may not have had access or be able to afford a smartphone require for the online survey. Furthermore, the survey context was reported to have noticeable social, political and security sensitivity according to Global Risk Mangers advisory (see Appendix 9 and 10). These challenges in survey context required the researcher to make some empirical judgements which could introduce elements of bias as already identified in the reflexivity.

10.7.4 The Researcher's Personal Limitation

The COVID-19 lockdown introduced complexities to the researcher especially concerning his finances and the economic situation of the home country from where funds were generated for tuition. This challenge meant that the researcher enrolment was disrupted in different instances during this PhD study. Despite, the known rigour associated

with a PhD study, the researcher as a part-time student with financial constraints suggests that this research study was conducted under strenuous circumstances and experiences. Nonetheless, the act of submitting a defendable PhD research suggests the researcher has been able to overcome these challenges for the next phase of his career.

10.8 Conclusion

This SES study has problematised, theorised, interrogated, and generated knowledge of Nigeria's social-economic problems to understand the economic complications in natural resource-dependent contexts from social perception. The first conclusion from this thesis is that data analysis demonstrates a rich natural resource system in the survey context comprising natural, biodiverse plants and animal species resident in the terrestrial, coastal, and marine ecosystems near oilfields in Nigeria. However, the centralised governance system dominance and prioritisation of oil mining activities subordinate the non-oil related attributed values to the natural resource system. This nature of competitive property rights impacts sustenance and livelihood sources serving resident social actors the income, and local communities' economic conditions that spill over to the national economic level. This challenge threatens other social-economic problems such as food shortages, inflation, unemployment, and poverty reduction, in ways that policy actors have been unable to comprehend.

The second conclusion from this thesis is that data analysis evidence reveals a relationship between social-political arrangement, institution structure, governance system capability. From this thesis research findings, governance system capability can be deterministic of social-economic outcome in natural resource-dependent contexts. The social perception that local community leadership (informal institutions) approach to social-ecological system stewardship and the governance system (formal institutions) capacity and

enforcement of oil mining in the same context, trades off the small-scale farming, fishing, food processing, trading, employment and poverty reduction value associated with non-oil natural resource values exploration in the social-ecological system around oilfields. Therefore, despite the empirical confirmation that the aggregated range of the often-undocumented nature of sustenance and livelihood activities are crucial to social-economic outcome, the inability of the Nigerian context's incoherent property rights, ineffective institutions and unpredictable social-political arrangement suggest the inability of the natural resource management institutions to completely wean itself from its colonial legacies.

The third conclusion is that well-structured theoretical framework can diagnose the influence of social-political arrangement on the effectiveness of institution structure not only by its effects on the social-ecological system, but by examining its capability and enforcement features. This study underscores that effective institutions linkage to social-economic outcome are dependent to the extent to which governance capability and enforcement can safeguard natural resource system values in the social-ecological system. The economic effect of unpredictable institutions for natural resource management in the social-ecological system around oilfields suggests the overlooked dimension of institution weakness linkage to economic problems in natural resource-dependent contexts.

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Appendix 1: Field Survey Interview Questions Capture of Mapped SESF Variables and Identified Indicators

	Oil Mining Communities' Respondents	**Oil Industry Experts' Respondents**
BACKGROUND INFORMATION	Prompt: Tell me about yourself generally Prompt: Tell me how long you have lived in this community	Prompt: Tell me about yourself generally Prompt: Tell me how long you have worked in the oil and gas industry
RESOURCE UNITS (Livelihoods Sources and Associated Human Wellbeing Benefits)	**To what extent do you think that there is a relationship between these environmental resources, your livelihood supplies and economic performance in your community?** Prompt: What are the natural resource benefits are commonly found in your community? Prompt: Can you tell me how these natural resource benefits in your local environment support your daily household upkeep needs? Prompt: What are the natural resources benefits most important to your household needs? Prompt: What factors are likely to impact the enjoyment of these natural resource benefits? Prompt: In addition to the main source of earnings, did you also engage in any subsidiary occupation for income sources? Why? Prompt: Aside from foods can you summarize the other natural resource benefits you enjoy around your environment?	**How effectively do you think that the natural resource governance laws and agencies protect and preserve of environmental systems and natural resources benefits to communities around oil mining fields?** Prompt: Can you describe the relationship between oil resource exploration, the environmental system condition and livelihoods source for human settlement around oil mining fields? Prompt: Generally, how would you describe government laws and agencies support for the preservation of natural resources benefits around oil mining communities? Prompt: What natural resource benefits do you thing are most important to human settlements around oil mining fields? Prompt: Can you describe other local activities around oil mining communities contributing to the peoples' wellbeing?
	Oil Mining Communities' Respondents	**Oil Industry Experts' Respondents**
RESOURCE SYSTEMS (Socioecological System Condition)	**Briefly describe the condition of your local environment where you work and earn a living**	**How successful is the natural resource governance institutions in regulating environmental systems preservation for**

	Prompt: How often did you worry that your immediate environment condition will not be able to support your households' source of income? Prompt: Can you tell me the two most important problems within your community? Prompt: How much do you think your community leaders know for the best outcomes in the community? Prompt: What type of support does your community get when they are informed any complications impacting your income sources? Prompt: If you experienced any form of complications to these natural resource benefits, which ones?	**natural resource benefits around oil mining settlements?** Prompt: To what extent do you think that there are relationships between environmental system condition and people wellbeing around oil mining fields? Prompt: How would you describe the relationships environmental system conditions and people's income level around oil mining communities? Prompt: Based on the experience, what are the most relevant challenges faced in protecting the environmental systems around oil mining fields?
	Oil Mining Communities' Respondents	**Oil Industry Experts' Respondents**
SOCIAL ACTOR'S INTERACTIONS (Local Community Governance)	**If there is a problem in the community, can you explain how people are likely to cooperate to resolve the problem?** Prompt: How would your political representatives respond to your community efforts in resolving the problems? Prompt: How would your community leaderships respond to your community efforts in resolving the problems? Prompt: In the past year, what type of community problems has your community members, leaderships and political representative jointly resolved? Prompt: What are your most important sources for information when there are environmental problems?	**What kind of relationship between your regulatory agency and human settlements around oil mining settlements?** Prompt: From your experience, how does your regulatory activities specifically support human settlements' concerns about their environmental system conditions? Prompt: What are challenges does your agency face in supporting subnational governments to preserve environmental system conditions? Prompt: What are your most important sources of information when there are environmental problems?

	Prompt: Could describe the relationship between the oil mining corporations and community? Prompt: Could describe the relationship between the government regulatory agencies and the community?	Prompt: Could describe the relationship between the oil mining corporations and community? Prompt: Could describe the relationship between the government regulatory agencies and the community?
	Oil Mining Communities' Respondents	**Oil Industry Experts' Respondents**
GOVERNANCE SYSTEMS (Institutional Regulatory Framework)	**How effectively do the government agencies protect and preserve the natural resource benefits of your environmental system?** Prompt: How do you think government regulations can do to reduce environmental problems in your community? Prompt: In what way do you think that local politics contribute regulations protecting environmental resources are designed? Prompt: What are your most important sources for information about government community development? **Prompt: Does the existing political arrangements provide the opportunity for community members to hold government accountable when fail in their responsibility?** Prompt: Has your community ever experience environmental problems because of oil mining activities? Can you describe any instance when government agency enforced oil mining laws to protect the environmental resources?	**Natural Resource Governance Laws and Agencies Formulations** Prompt: Do think that well-structured resource governance laws are important for natural resource preservation? Prompt: What economic consideration do you think are prioritised when formulating natural governance laws? Prompt: To what extent do you think that there is a relationship between natural resources benefits preservation and economic opportunities in human settlements around oil mining fields? Prompt: What kind of support does your agency provide support to subnational governments to reduce the adverse effects of oil and gas explorations around human settlements?

Appendix 2: Field Survey Questionnaire Capture of Mapped SESF Variables and Identified Indicators

Variables	Survey Questions	Answer Possibility
<u>Resource System (RS)</u> 1. Description of natural resource system assets. 2. Human-constructed facilities 3. Productivity of system	Which of the underlisted local environmental resources is more common around local oil mining communities?	A) Healthy natural environment B) Fertile land, diverse farm produce and medicinal plants. C) Large bodies of water, diverse fishes and other seafoods D) Tropical rainforest and mangrove forest E) All of the Above
1 Resource Interaction with Human-constructed facilities	Can you share an experience of when local communities experienced environmental problem because of oil mining activities?	A. Government agencies provided palliatives B. There was no form of support C. Private Individuals Provide Palliatives D. Oil Mining Companies Provide Palliatives E. Not Sure
<u>Resource Units (RU)</u> 1. Distinctive characteristics of Resource Units. 2. Productivity and Economic Potentials.	Which of the underlisted local environmental resources is more common around local oil mining communities?	A. Healthy natural environment B. Fertile land, diverse farm produce and medicinal plants.

		C. Large bodies of water, diverse fishes and other seafoods D. Tropical rainforest and mangrove forest E. All of the Above
<u>Interaction (I)</u> 1. Productivity and Economic Potentials 2 Social wellbeing markers. 3 Productivity and Economic Potentials	Quality of water sources for household domestic use around oil mining community?	A. No Change B. Decrease C. Increase D. Not Sure E. No Answer
	Quality of plants, forest and wildlife around oil mining community?	A. Decrease B. Not Sure C. Increase D. Stay the Same E. No Answer
	Quantity and quality of fish and other sea foods caught from the nearby rivers and sea?	A. Not Sure B. Increase C. Decrease D. Stay the Same E. No Answer
	Quantity and quality of farm crops harvest?	A. Increase B. Decrease C. Not Sure D. Stay the Same E. No Answer
4 Available economic/ non-economic opportunities.	Economic condition around oil mining communities?	A. Decrease B. Increase C. Stay the Same D. Not Sure E. No Answer

5 Social wellbeing markers.	Household income sources of people living around oil mining community?	A. Decrease B. Increase C. Stay the Same D. Not Sure E. No Answer
	Perception of individual health condition of people living around oil mining community?	A. Stay the Same B. Decrease C. Increase D. Not Sure E. No Answer
	What more do you think oil industry regulators can do to reduce difficult community problems?	A. Emphasis on enforcing existing regulations B. Not Sure C. Improve their capacity D. Design new regulations E. No Answer
6 Cordiality 7 Conflictual Situations.	Could you confirm the kind of relationship that exists between oil industry regulatory agencies and people living around oil mining communities?	A. Cordially B. Not Cordial C. Do Not Know D. No Answer
	Could you describe the relationship that exists between the oil mining corporations and the community people?	A. Cordially B. Not Cordial C. Do Not Know D. No Answer
	Could you describe the relationship that exists between the oil mining corporations and the community people?	A. Cordially B. Not Cordial C. Do Not Know D. No Answer
<u>Governance System (GS)</u> 1. Evidence of operational rule enforcement.	In your experience, what do you think about the manner in which the oil industry regulatory agencies enforce regulations to protect the local natural environment?	A. Effective B. Not Effective C. Do Not Know D. No Answer

2. Governance System Performance 3. Social wellbeing markers. 4. Coordination and maintenance of humanly constructed infrastructures.	Security situation of people living around oil mining community?	A. Decrease B. Increase C. Stay the Same D. Not Sure E. No Answer
	What do you think about the condition of basic social amenities and public infrastructure such as roads, schools, and health centres around oil mining communities?	A. In Good State B. On Going Rehabilitation C. In Bad State D. Not Available at All E. I do not Know
	What more do you think oil industry regulators can do to reduce difficult community problems?	A. More Emphasis on Enforcing Existing Regulations B. Not Sure C. Improve Their Capacity D. Design New Regulations E. No Answer
<u>Social Actors (SA)</u> 5. Background of Actors	What is the main income source of people living around oil mining communities?	A. Paid employment B. Informal artisan service C. Farming D. Fishing E. Trading F. Day Labour
6. Survey Population Representativeness	Where are you participating in this interview from?	A. Akwa Ibom B. Bayelsa C. Cross River D. Edo E. Delta F. Rivers G. Lagos F. Abuja
	Have you ever visited any community with oil and gas facilities or installations around the Niger- Delta?	A. Yes B. No C. Not Sure

		D. No Answer
7. Leadership Performance	From your experience, what do you think about the manner in which the local community leaders interact with governance agencies and oil companies to seek solutions for difficult community problems?	A. They represent the people's concerns. B. They are fighting for their own interests C. They are concerned about government interests D. They are concerned about oil companies' interests E. Not Sure
	From your experience, what do you think about the manner in which the local political representatives interact with governance agencies and oil companies to seek solutions for difficult community problems?	A. Representing the peoples' concerns. B. Fighting for their personal interests. C. Concerned about oil companies' interests D. Concerned about government economic interests E. Not Sure
Setting (S)	Which of the underlisted local environmental resources is more common around local oil mining communities?	A. Healthy natural environment B. Fertile land, diverse farm produce and medicinal plants. C. Large bodies of water, diverse fishes and other seafoods D. Tropical rainforest and mangrove forest E. All of the Above

Outcome (O) Social-Economic System	What do you think is the most difficult problem faced by people living around oil mining communities?	A. Loss of land to ocean surge and encroachment B. Lack of basic social infrastructure C. Local Community Leadership Challenge D. Increase in poverty and Unemployment E. Decrease in Local resident income because of environmental degradation F. All of the Above 8. None of the Above
	Do you think that the consequences of oil mining activities on local environmental resources' economic opportunities and social wellbeing around the Niger Delta contribute to Nigeria's economic problems?	A. NO B. I do not Know G. Yes

Appendix 3: Criteria for Designing Codes and Field Data Analysis

This code dictionary interprets and compiles categories to which the attributes from textual analysis. As a study that engaged in primary data collection on SES condition and social-economic outcome, this study designed a dictionary to code field survey evidences using the SESF variables (Ostrom and McGinnis, 2014), the identified indicators applied for data collection and peer-reviewed primary studies (Tribaldos et al (2020; Herzog et al., (2022). Also suggested marker based on the social, economic and environmental system gaps cited from literatures analysed in the problematisation of the retrench phenomenon. For example, Tribaldos et al (2020) conducted a meta-analysis of 29 case studies in agricultural settings to analyse the intensity of social actor interactions and sustainability impacts, while Herzog et al (2022) provide an elaborate guideline. However, codes that describe the social-ecological system interaction were generated based on the influence by theoretical analysis. However, codes generated inductively based on the leading of field survey evidence generated during the course of the data analysis. The rationale for this design of the codebook for the data analysis was to enable replicability with the possibility of providing a common language for analysis SESF variables. Thus, the result from this qualitative data analysis should be understood as a synthesis of field survey evidences

SESF First Tier Variables	Code	Description	Markers	Outcome	Code Source
SETTINGS	Infrastructure	Identifiable natural and humanly designed public infrastructures that contribute to human improvement and economic opportunities.	Availability and current condition of both natural infrastructure and human-made infrastructure.	Social/Economic	Literature review
	Contextual realities	The actual reflection of social, ecological, economic and development status as they exist.	Based on respondent's description of contexts.	Economic	Literature review
	Entrepreneurship	The responsiveness to harness available economic opportunities as a means of livelihoods and communal progress.	Initiatives for self-generation of income activities.	Economic	McGinnis and Ostrom, 2014

RESOURCE SYSTEM Resource systems comprise of the subset of different biological components and non-living things that inhabit, mobile and interreact to deliver natural goods and services.	Configuration of contextual resource system	The diversity and categorization of the common pool resources based on the sector	Based on existing scientific studies categorization (e.g., water bodies, soil, forests formation, Air) and survey respondent description.		McGinnis and Ostrom, 2014
	Resource System Productivity	The potential of the resource system to yield and replenish according its natural cycles.	Description of condition of replenishment and harvest cycles.	Social/Ecological	McGinnis and Ostrom, 2014
	Human-constructed facilities	These artificially constructed infrastructures by human actions to guide, influence and shape the efficient flow of natural resource benefits within a resource system.	Identifiable human-constructed facilities around survey contexts	Social	McGinnis and Ostrom, 2014
	Exposure to extreme weather condition	Rare natural occurrences of climate events such as rain, flood, storm or drought that poses increased risk	Recorded incidence of climate events around contexts	Social/Ecological	McGinnis and Ostrom, 2014

	(Sustainability)	to resource system, with intensity on social and economic systems.			
RESOURCE UNIT Units of resources within the broader resource system that inhabit and interact in biophysical processes to produce natural goods and services.	Distinctive characteristics of Resource Units.	The level of people reliance on local natural resources main sources of sustenance and livelihoods without other visible alternatives	Reported cases of natural resource use by different actors	Social/Ecological	McGinnis and Ostrom, 2014
	Economic Potentials of Resource Units	The description of resource units based on its enjoyable natural resource benefits. (economic and non-economic opportunities).	Harvestable natural resource benefits to support social, ecological or economic systems sustainability.	Social/Ecological/ Economic	Literature review
	Level of dependence on resource system/units	Persistence of people's access and consumption of resource units either for sustenance or as livelihoods source around survey contexts	Population in community depending on the diversity of resource units for sustenance and livelihoods.	Social/Economic	McGinnis and Ostrom, 2014

	Access to resource units harvesting.	The freedom to harvest common-pool resources, social security systems, or other public infrastructure.	Ease of accessing natural resource benefits without formal or informal regulatory constraints.	Social/Economic	Literature review
INTERACTION	Common resource pool and humanly constructed assets.	The interactions and influence between human actions and ecosystem functioning within resource systems.	The condition and outcome of resource system based on human influenced actions to explore and harvest natural resource benefits.	Social/Economic	McGinnis and Ostrom, 2014
	Competition	Contest by different actors based on different claim of legitimacy for available resource units within the same resource system.	Identifying areas where actors compete for interdependent resources benefits in the same resource system/ecological system.	Social/Economic	Tribaldos et al, 2020
	Available economic/ non-			Social/Economic	Literature review

	economic opportunities.				
	Conflictual situations	Issues that are likely to harm components or the generality of resource system and actors.	Reported cases of conflicts between or within actors around survey contexts.	Social/Economic	McGinnis and Ostrom, 2014
SOCIAL ACTORS	Background of actors	This code informs about the involved actor groups, networks, familiarity, motivation and capacity of the involved actors, and the power constellation.	Descriptions of actors by different layers of survey respondents.	Social	McGinnis and Ostrom, 2014
		Actors Capacity	The availability of knowledge, time individual/collective competence, material resources to harvest natural resource benefits within a resource system.	Social/Economic	Literature review

		Persistency	Resilience and fortitude to explore natural resource benefits opportunities amidst resource system attaining depletion threshold based on conflictual situations from either as a result of difference between political actors, property rights or oil mining companies' inability to reach commonality; or extreme weather conditions.	Social/Economic	McGinnis and Ostrom, 2014
	History of natural resource use	The pedigree of natural resource benefits enjoyment for human sustenance and livelihood sources.	Evidence on duration of resource systems exploration as communal resource.	Social/Economic	
	Social Wellbeing Markers	Commonly indefinable sources of livelihoods around survey contexts.	Reported sources of human engagement and activities that generate income and livelihoods around contexts.	Social/Economic	Literature review

	Leadership	Identification of different layers of both informal/formal coordinating that set goals, mobilises human actions, design shared human behaviours constraints and incentive to guide or resolve conflictual situations when accessing common resource pool resource.	The perception of respondents about the performance of different layers of both informal/formal coordinating units.	Social/Economic	McGinnis and Ostrom, 2014
GOVERNANCE SYSTEM	Operational rule A set of social and formal prescription	Monitoring Enforcement and Sanctioning	Moderation of the compliance to pre-defined social and formal prescription.	Social/Economic/ Ecological	Schluter et al., 2022; Herzog et al, 2022

The collection of social prescription, formalised constraints and incentive for regulating, enforcing and monitoring the exploration and harvest of common pool resource system.	moderating the exploration and harvest of common pool resources for resource system sustainability.	Transparency	The degree of information and decision disclosure of governance system design, enforcement and monitoring.	Social/Economic/ Ecological	Literature Review (Chapter Four)
		Participation	The inclusion of all actors (both formal and informal) to evolve, design, enforce and monitor operational rule in resource system.	Social/Economic/ Ecological	McGinnis and Ostrom, 2014
		Accountability	The extent to which an institution and governance system, means, mechanisms and process render stewardship for public scrutiny.	Social/Economic/ Ecological	McGinnis and Ostrom, 2014
	Coordination and maintenance of humanly	The mobilisation of social actors both formal and informal, to operational rule adherence when	Events of social and economic interactions specifically designed to enforce and monitor pre-defined social	Social/Economic/ Ecological	Literature Review

	constructed infrastructures	exploring resource system wealth either oil mining activities or other forms of resource system harvesting.	and formal prescription for resource system sustainability.		
	Participation in decision making	Relating to the composition of structures and mechanisms that defines how social and formal prescription evolve, develop and interact as operational rule for enforcement and monitoring.	The influence of different stakeholders to enforce and monitor the compliance to pre-defined social prescription and operational rule.	Social/Economic/ Ecological	Literature review (Chapter Four)
	Governance System Performance	The effectiveness of pre-defined social prescription and operational rule in regulating and strengthening resource systems.	The perception on governance system performance in sustaining the resource system natural replenishment cycle.	Social/Economic/ Ecological	Literature Review (Chapter 3)

OUTCOME Outcomes of different interdependent and independent actions within resource systems that generate varying values at the same time or future system components.	Social-Economic The influence of existing condition of resource system components on Human wellbeing, livelihood sources and development potentials	Terrestrial Ecosystems	Findings and interpretation from field data analysis.		Literature Review
		Coastal and Marine Ecosystem The marine ecosystems encompass those marine areas deeper than 50 meters, while coastal ecosystems are areas located between 50 meters below mean sea level and 50 meters above the high tide level. Coastal ecosystems could extend over the continental shelf and inland up to 100 km from the shoreline. This classification represent complex an inter-relationship of the ecosystems. In	Social Benefit of Fishery and Aquatic Life The influence resource unit on human sustenance and improvement aspirations.		Literature Review (Chapter 3)
			Nutritional/Medicinal Fishery The dietary and health value of resource units to human sustenance and improvement aspiration.		Literature Review (Chapter Four)
			Water Transportation The contribution of coastal and marine economy for human movement, and materials supply and trade.		Literature Review

		fact, they are formed by a variety of ecosystems (Freeman et al, 2013)			
		Fresh drinking water is water extracted from natural source that is fit for human consumption	Quality and quantity of refresh water system such as rainfall, dug well, stream, rivers and public infrastructure.		Literature Review Chapter Four
		Natural recreational facilities simply represent the background settings of the natural resource system where people can enjoy outdoor leisure activities within the social-ecological system setting.	Quality of the aspect of the natural biodiversity that people explore for the purpose of leisure depending on the individual preference. (For example, coastal and marine ecosystem for swimming and fishing, terrestrial ecosystem for hunting and hiking)		Literature Review
		Condition of Basic Social Infrastructure			Literature Review

		Governance System			Literature Review (Chapter Two, and Three)
		Security Situation Description of the safety of lives and property in the contexts against any danger and threat of criminal activities.	The degree to which to social-ecological system allow for peaceful coexistence of social-economic activities without disruptions		Literature Review (Chapter Three)

Appendix 4: Participant Information Sheet



PARTICIPANT INFORMATION SHEET

Interview (structured and semi-structured)

INVITATION

You are invited to participate in this research survey. However, before you decide, it is important that I read the purpose and what your participation in this survey entails to your understanding. Please listen carefully while I read.

RESEARCH TOPIC: Understanding the Natural-Resource Dependent Nigeria's Economic Problem from a Social-Ecological Systems Perspective.

WHO AM I?

My name is Nosayaba Odemwingie Oka, a Nigerian PhD Researcher with the University of Gloucestershire.

WHAT IS THE PURPOSE OF THE STUDY?

This survey is seeking to collect data on oil resource governance, local environmental resources, and economic opportunities. Nigeria's economic opportunities revolve around oil mining social-ecological systems. The aim is to contribute to the knowledge on the missed economic opportunities impact on Nigeria's economic performance from social-ecological system conditions. For emphasis, the research objectives are not driven by activism, nor is it a fact-finding mission. Rather, the purpose of this survey is mainly to contribute scientific knowledge in line with the research aim and objectives. Thus, the research does not, nor does it intend to target individuals or organisations, except where a publicly available dataset related to this research subject is cited in the bibliography section. Therefore, when you are

answering the survey questions, it is not necessary to mention names of individuals or organisations (either positively or negatively).

WHY HAVE YOU BEEN INVITED TO TAKE PART?

You have been chosen because you are a Nigerian, a native, or a resident in one of these communities around the Niger Delta region. For this reason, you may have knowledge about the relationship with ecological systems, wealth, regulatory governance, oil mining activities, and the local people's livelihood sources.

DO YOU HAVE TO TAKE PART?

Participation in this survey is voluntary, and it is up to you to decide to participate. If you decide to participate, you can request a written copy of this information sheet for keeps. Also, you can choose to withdraw at any time without necessarily giving a reason for withdrawal. The field study will respect and treat all respondents' ethically as co-creators of knowledge.

WHAT WILL TAKING PART INVOLVE?

Participating in this survey essentially requires you to answer the interview questions, which will take averagely about 30 minutes. There are no other commitments associated with this research beyond answering the survey questions. Also, you can choose to answer the questions you feel comfortable with to the best of your understanding, using your own opinion and perspective. You do not have to answer all questions, and you are at liberty to skip any question. Additionally, you may wish to agree to a follow-up interview to find out more about the subject of study.

WILL TAKING PART BE CONFIDENTIAL?

When responding to the survey questions, your identity will be treated as anonymous. This implies that you will be provided with a pseudo (decoy) identification for this survey, e.g., 'Participant A'. Also, all the information collected from you during the interview will be kept

strictly confidential. This means you will not be identified or identifiable in any reports or publications after the study.

WHAT ARE THE POSSIBLE RISKS AND BENEFITS OF TAKING PART?

Participating in this research is not anticipated to cause you any disadvantage or discomfort. Rather, it provides you the opportunity to contribute to scientific knowledge as co-creator knowledge.

WILL YOU BE RECORDED?

If you are participating in the verbal interview session, the answer to the survey question will be recorded using an audio device only. At the completion of the survey, you can request an audio recording to be played back for your listening to reconfirm the survey answers. Kindly note that you are at liberty to request an adjustment to the audio recording.

USING YOUR MOBILE DEVICE TO SNAP AND SEND PHOTOGRAPHIC IMAGES

You can agree to use your mobile device to photograph the geographic images of the conditions of your local environmental system. Kindly note that this request is purely optional and voluntary. However, if you refuse to use your mobile device to photograph your local environment, it will not in any way affect the other aspect of this survey. Nonetheless, please note that you cannot include other people in your photography without their consent. Also, kindly note that by agreeing to send photographs of your environmental system, you will also be agreeing to send the accompanying information (such as time, date, and geolocation) of the device or mobile phone used for snapping the photographic images.

WHAT TYPE OF INFORMATION WILL BE SOUGHT FROM YOU AND THE RELEVANCE TO THE RESEARCH OBJECTIVES?

The survey question will ask about your views and experience on the local environmental resources, oil exploration, and industry regulatory, and its consequences on the economic potentials of people living around oil-endowed communities.

HOW WILL INFORMATION YOU PROVIDE BE RECORDED, STORED AND PROTECTED?

All survey evidence collected as data will be backed up and stored on the University of Gloucestershire OneDrive cloud to prevent unauthorised access at the completion of the interview.

WHAT WILL HAPPEN TO THE RESULTS OF THE STUDY

Survey evidence will be analysed to generate research findings; data and related records will be published in scientific publications, presented at conferences, and deposited in the University of Gloucestershire repository.

WHO SHOULD I CONTACT FOR FURTHER INFORMATION?

The underlisted people with the address below can be reached for further clarifications.

Dr Dilshaad Bundhoo

School of Natural and Social Sciences

University of Gloucestershire

The Park, Cheltenham, United Kingdom

dbundhoo@glos.ac.uk

Prof. Kenny Lynch

School of Natural and Social Sciences

University of Gloucestershire

The Park, Cheltenham, United Kingdom

klynch@glos.ac.uk

Dr. Robin Bown

Research Ethics Committee Vice Chair

University of Gloucestershire

The Park, Cheltenham, United Kingdom

rbown@glos.ac.uk

You are at liberty to ask questions on areas that are not clear to you.

Thank you for your time.

Appendix 5: Electronic Informed Consent Form

UNIVERSITY OF GLOUCESTERSHIRE

ELECTRONIC INFORMED CONSENT FORM

Title of Project:

Exploring the Nigeria Economic Phenomenon from the Missed-Economic and Non-Economic Opportunities of Socioecological System Wealth around Oil Mining Frontiers

Name of Researcher:

Nosayaba O. Oka

Project summary:

I am from the University of Gloucestershire in the United Kingdom, I will like to talk to you about your experiences and perceptions of oil resource wealth, and the implications of oil resource governance on environmental system and human wellbeing condition around your community.

Name of Participant _____

Participant ID number _____

Date of interview _____

Name of Interviewer(s) _____

Participation in this interview is completely voluntary. You do not have to answer questions if you do not want to do so. You can decide not to take part at any time during the interview.

Signature of Interviewee(s) _____

Participant has agreed to take part in the above study after briefing ☐

Participant has agreed to take part in the above study after briefing

Appendix 6: University Ethics Approval

UNIVERSITY OF GLOUCESTERSHIRE

Dr Emily Ryall
Research Ethics Committee Chair
Reader in Applied Philosophy

Oxstalls Campus,
Longlevens, Gloucester, GL2 9HW

Tel: +44 (0)1242 715237
Email: eryall@glos.ac.uk

Via email

Nosayaba OKA
[redacted]

15 June 2023

Dear Nosayaba

Thank you for your application for ethical approval.

I am pleased to confirm ethical clearance for your research following ethical review by the University of Gloucestershire's Research Ethics Committee (REC).

Please keep a record of this letter as a confirmation of your ethical approval.

Project Title:	'Exploring the Governance of Oil Resource Endowment in Nigeria; Economic Development and Socio-Ecological Systems around Oil Mining Frontiers.'
Start Date:	13 June 2023
Projected Completion Date:	25 September 2023
REC Approval Code:	REC.22.33.1

If you have any questions about your ethical clearance please feel free to contact me. Please use your REC Approval Code in any future correspondence regarding this study.

Good luck with your research project.

Regards,

[redacted]

Dr Emily Ryall
Chair of Research Ethics Committee

University of Gloucestershire The Park Cheltenham GL50 2RH The University of Gloucestershire is a company limited by guarantee registered in England &Wales. Registered number: 06023243. Registered office: The Park, Cheltenham, GL50 2RH. Tel **0844 801 0001** www.glos.ac.uk

Appendix 7 JISC Downtime Notification

Ongoing issue with online surveys

Sophie Haworth <Sophie.haworth@jisc.ac.uk>
Wed 8/16/2023 4:28 PM
To:Oka, Nosayaba <nosayabaoka@connect.glos.ac.uk>

CAUTION: This email originated from outside the organisation. Only click links or open attachments when you can confirm the sender and know the content is safe. If unsure, contact itandlibrary@glos.ac.uk



Open this email as a web or plain text version.
Add us to your safe senders list.

Good afternoon,

We are experiencing an ongoing issue with response submission in Jisc Online Surveys.

In some cases, respondents are receiving an error message upon submission, resulting in their response not being recorded.

Our developers are working hard to find a solution, but in the meantime we would recommend not launching any new surveys and, if possible, temporarily pausing any open surveys until the issue has been resolved.

We apologise for the inconvenience this will cause. Our support team is updating the message on the online surveys status page with more information as it becomes available.

If you have an urgent query, please contact help@jisc.ac.uk.

Kind regards,

Sophie Haworth
Head of customer success operations and communities management

Appendix 8 JISC Downtime Notification

Re: Online Surveys update

Oka, Nosayaba <nosayabaoka@connect.glos.ac.uk>
Thu 8/17/2023 2:26 PM
To:Sophie Haworth <Sophie.Haworth@jisc.ac.uk>

Dear Sophie Haworth,

Many thanks to you and your team member for the prompt response to troubleshooting the online glitch. I look forward to a hitch free data gathering exercise.

Best regards

Nosayaba Oka

From: Sophie Haworth <Sophie.Haworth@jisc.ac.uk>
Sent: Thursday, August 17, 2023 2:10 PM
To: Oka, Nosayaba <nosayabaoka@connect.glos.ac.uk>
Subject: Online Surveys update

CAUTION: This email originated from outside the organisation. Only click links or open attachments when you can confirm the sender and know the content is safe. If unsure, contact itandlibrary@glos.ac.uk

Jisc

Open this email as a web or plain text version.
Add us to your safe senders list.

Good afternoon,

Further to my email yesterday, I'm pleased to say that we have found a fix for the issue with response submissions in Online Surveys. The platform is now functioning as usual.

We are monitoring the platform closely while continuing our investigation into what caused this issue, to try and protect against any possible reoccurrences.

We first became aware of a possible issue with response submission on Thursday 10 August. Our initial testing suggested this to be a one-off error affecting a single user. Unfortunately, the issue evolved and, over the last 48 hours, a larger number of respondents started to encounter the error. We anticipate that the majority of survey responses submitted this week will not have been received. Each time the respondent will have received the error message.

Any existing data collected from surveys prior to 10 August is unaffected.

We apologise again for the inconvenience we know this will have caused. If you have any urgent queries or require further assistance, please contact

Appendix 9: Country Intelligence Risk Report

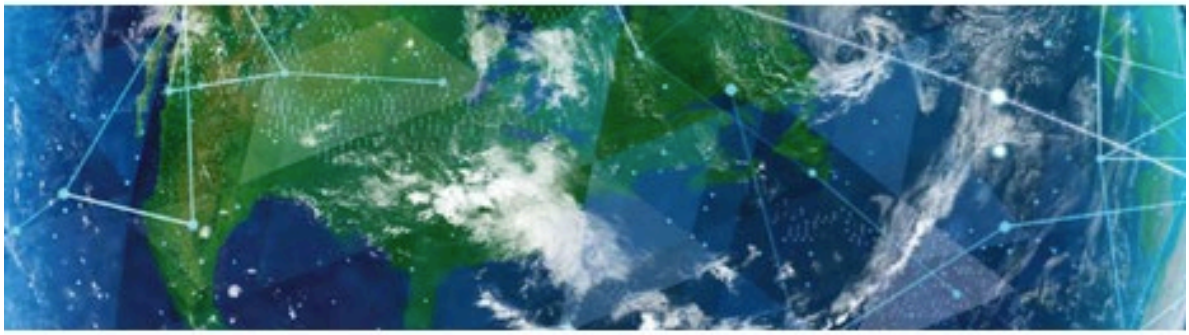
drum cussac
A GARDAWORLD COMPANY

Intelligence and Analysis Services

Country Intelligence Risk Report

Nigeria

Overall Risk Rating: High | 4.00



Drum Cussac Group Limited

Last Updated: 14 Feb 2023, 13:03 (UTC)

Appendix 10: Country Risk Rating Breakdown

Country Risk Rating Breakdown

Country Overall Risk Rating	
	High | 4.00

Security Risk Rating			
		High | 4.25	
Conflict	**Criminality**	**Terrorism**	**Unrest**
High | 4.00	High | 4.25	High | 4.00	High | 4.00

Environmental Risk Rating			
		Moderate - High | 3.50	
Seismic	**Storm Systems**	**Climatic**	**Manmade**
Negligible | 1.25	Moderate - High | 3.50	Moderate - High | 3.50	High | 4.00

Infrastructural Risk Rating			
		Moderate - High | 3.50	
Aviation	**Overland**	**Utilities**	**Cyber**
Moderate | 3.25	Moderate - High | 3.75	Moderate - High | 3.75	Moderate - High | 3.75

Political Risk Rating			
		Moderate - High | 3.50	
Government Stability	**Corruption**	**Rule of Law**	**Sanctions**
Moderate - High | 3.50	High - Extreme | 4.50	Moderate - High | 3.50	Negligible | 1.25

Medical Risk Rating			
		High - Extreme | 4.50	
Disease	**Facilities**	**Pharmaceuticals**	**Water**
High | 4.00	High - Extreme | 4.75	Moderate - High | 3.50	Moderate - High | 3.75

Appendix 11: Field Data Analysis

Codes Results

Name	Description	Files	References
Actors		24	501
Background of Actors		24	237
History of natural resource use		18	41
Leadership		23	107
Social Wellbeing Markers		22	116
Governance System		24	366
Decision Making		9	18
Governance System Performance		19	63
Operational Rule		24	203
Accountability		20	49
Monitoring and Enforcement		23	84
Participation		18	41
Transparency		13	28
Social Infrastructure Coordination and Maintenance		16	82
Interaction		24	477
Available Economic and Non-Economic Opportunities		24	260
Competition		11	27
Conflictual Situations		22	97
Cordiality		22	69
Resource System and Oil Fields Interface		5	24
Air Pollution		12	40
Fresh Drinking Water		6	7

Name	Description	Files	References
Natural Recreational Infrastructures		17	44
Oil Spill		24	177
Coastal and Marine Ecosystem		19	55
Fresh Drinking Water		13	28
Soil Fertility		16	29
Outcome		24	252
Social-Economic Outcome		24	252
Basic Infrastructures Condition		21	65
Governance System Effectiveness		1	1
Security Situation		19	69
Social Impacts		23	113
Resource System		23	217
Exposure to Extreme Weather Conditions		12	31
Human-Constructed Facilities		22	50
Natural Configuration and Description		23	100
Productivity and Economic Potentials		14	35
Resource Units		24	238
Access and Harvesting		11	22
Distinctive Characteristics and Description		20	90
Productivity and Economic Potentials		20	74
Ratio of Human Dependence		20	51