Systematising Associated Gas Flare Governance

Entonu Augustine Oyiyole

200807299

Submitted following the requirements for the degree of

Doctor of Philosophy

The University of Leeds

Sustainability Research Institute

School of Earth and Environmental Science

December 2021

Intellectual Property and Publication Statements

I confirm that the work submitted is my own and that appropriate credit has been given where reference has been made to the work of others.

Acknowledgements

Abstract

Existing associated gas flare governance research does not explicitly focus on its end-to-end systematisation as goals, instruments and processes. Besides, the existing research hardly connects barriers or traces the root origins of challenges to devise targeted policy solutions. This thesis provides an end-to-end systematisation of associated gas flare governance at the global and Nigerian levels to fill the knowledge gap. It raised significant concerns about barriers and traced root origins of barriers but offered targeted policy solutions.

The materials used comprised documents and expert interviews from five global associated gas flare governance initiatives, eight Nigerian governmental organisations and private sector partners including International Non-government Organisations with associated gas flare governance interest and responsibilities. The analyses were exploratory, descriptive, gauging and evaluative. Concept-driven, thematic, and narrative also supported the analysis to generate three significant findings.

First, a lack of intelligent coordination, steady communication and a mutual sense of direction lead to incoherent goals in associated gas flare governance. The policy solutions start with better orchestration and advocacy and could progress to a shared purpose of securing goal coherence.

Second, ineffective knowledge, market and normative instruments mean uncoordinated and ineffective instruments in associated gas flare governance. The policy solutions include better knowledge management, effective use of climate risk, accurate data and tackling high counterparty risk, supported by a collaborative standards development process.

Third, not knowing whom to collaborate with, a lack of enabling environment and capability means inefficient processes in associated gas flare governance. The suggested policy solutions include constant monitoring and evaluation of activities, enhancing regulatory clarity through national strategic implementation, and building capabilities through better coordinated global efforts.

The findings are relevant for actors looking to influence and shape associated flare gas governance. Overall, the barriers and root origins to a systematised associated gas flare governance may be relatively easier to tackle than other environmental governance barriers because the system is at a formative stage. The way forward is coordinated action at both levels with coherent goals linked to national priorities in associated gas flare governance. An implementation focus is needed to increase the implementation projects at 16,000 global flare sites.

Table of Contents

List of Tables

List of Figures

Abbreviations

AG: Associated Gas

AM0009: A CDM method, specifically designed by the UNFCCC, to be used to generate climate finance for projects which capture and use gas that would otherwise have been vented or flared.

CCUS: carbon capture, use and storage – a new technology proposed to capture carbon from industrial processes and bury them underneath the earth as a part of climate actions.

CDM: Clean Development Mechanism.

CoP: Conference of Parties meeting, which happens every year, but the 5th year is critical for strategic planning and forward-looking climate action. The UK and Italy are co-chairing the 26th CoP.

DCC: Nigerian Department of Climate Change, under the Ministry of Environment as a co-regulator of the gas sector from the climate change perspective.

DfID: the United Kingdom, Department for International Development; but now the Foreign and Commonwealth and Development Office (**FCDO**).

DISCOS: Nigerian Electricity Distribution Companies.

DNA: Designated National Authority under the Clean Development Mechanism Programme.

DOE: Designated Operating Entity acts for the UNFCCC as a country agent for the UNFCCC Clean Development Programme.

DGR: Nigerian Department for Gas Resources, proposed as a single, independent gas regulator following the 2017 National Gas Policy.

DPR: Nigerian Department for Petroleum Resources, within the Nigerian Ministry of Petroleum Resources.

ERCB: Canada's Energy Resources Conservation Board.

EITI: Extractive Industries Transparency Initiative.

[xiv]

F2V: Flare 2 Value; a commercial entity leading on innovative business models for associated gas commercialisation and currently working with the government of Oman.

Flaring: Flaring is the burning of gas that leads to GHG emissions (Colombo et al., 2015). Gas flaring occurs at oil exploration sites, and countries could secure flare-out through better licensing.

FOSTER: Facility for Oil Sector Transparency and Reform in Nigeria.

Gas: Used instead of associated gas.

GENCOs: Nigerian Electricity Generation Companies.

GEG: Global Environmental Governance.

GHG: Greenhouse Gas.

GIF: Global Infrastructure Facility.

GGFR: Global Gas Flaring Reduction Partnership; a World Bank orchestrated initiative, specialised in tackling gas flaring.

GMI: Global Methane Initiative, previously known as Methane to Market Partnership, sponsored by the USA Environmental Protection Agency.

INDC: Intended Nationally Determined Contribution.

IPCC: Intergovernmental Panel on Climate Change.

JVA: Joint Venture Agreement.

MEA: Multilateral Environmental Agreement.

MPR: Nigerian Ministry of Petroleum Resources.

MoE: Nigerian Ministry of Environment.

NBET: Nigerian Bulk Electricity Trading Company.

NCDMB: Nigerian Content Development Management Board.

NDC: Nationally Determined Contribution – meaning conditional and unconditional commitments by Conference of Party country members to the Paris Agreement to reduce their GHG.

NESREA: National Environmental Standards and Regulations Enforcement Agency.

NEITI: Nigerian Extractive Industries Transparency Initiative.

NGFCP: Nigerian Gas Flare Commercialisation Programme.

NNOC: Nigerian National Oil Corporation.

NNPC: Nigerian National Petroleum Corporation.

NPC: National Petroleum Commission* there is also a Nigerian Petroleum Company.

NAPAMC: Nigerian Petroleum Asset Management Company.

NPC: Nigerian Petroleum Company.

OGCI: Oil and Gas Climate Initiative; a global initiative set up by the top-ten oil companies to tackle climate change.

OSIWA: Open Society for West Africa.

SDG: Sustainable Development Goals.

SPDC: Shell Petroleum Development Corporation.

UNEP: United Nations Environment Programme.

UNFCCC: The United Nation's Framework Convention on Climate Change.

UNFCCC CDM AM0009: A Clean Development Mechanism targeted at the oil and gas sector. AM0009 supplies climate finance for projects to capture and use gas that would otherwise be vented or flared.

USAID: United States Agency for International Development.

WBWGI: World Bank Worldwide Governance Indicator.

WRI: World Resources Institute.

ZRF: Zero Routine Flaring by 2030; a World Bank initiative specialised in tackling gas flaring globally.

Definition of keyword, phrases and their context

Barriers to better associated gas flare governance: A barrier is a factor that prevents a governance system from reaching a minimum, viable state, and it affects other barriers and influences.

- **Emerging barriers**: a barrier is emerging if the insights are derived from document analysis pending verification from interviews and other source. There are eleven emerging barriers to the systematised global and Nigerian associated gas flare governance:
- **Significant barrier:** a significant barrier is one with at least four connections to other barriers and influences and a root origin is one with at least four connections to other origins and barriers.
- **Origin of barriers and root origins**: An origin is where a barrier starts an origin is a root origin related to four or more origins and/or barriers.
- **Influences and new(er) ways of thinking associated gas flare governance**: An influence is an outcome of a barrier. An influence is affected by a barrier. There are nine influences: three for each of the three aspects of my research (goals, instruments, and processes).

Blue and green hydrogen: blue hydrogen is created through reformation of gas molecules and green hydrogen through electrolysis of water molecules. However, for blue hydrogen to be sustainable, carbon capture, usage and storage needs to work. While there are views as to the climate impact of blue hydrogen, I only differentiate the two here for clarity rather than from a desire to be drawn into the debate – for now.

Discursive switching: Originates from discursive dynamics (Beunen and Patterson, 2016; Morrison et al., 2019). Discursive switching is where degrees of ambiguity and scope allow for a more suitable interpretation by actors of what is expected of them. This means powerful actors pick and choose interpretations and contestations of debates in climate change to suit their own powerful constituents.

Disentangled energy system: At a fundamental level, an energy system comprises of sources of primary energy (renewable and non-renewable) energy distribution infrastructure and consumption (industrial and domestic) among others. A disentangled energy system is one that applies a reductionist approach takin apart its components and examining them for transformative climate action. For this thesis, the focus is on a primary energy source – associated gas, and its potential use instead of the being flared. In the associated gas flare governance space, I refer to this

disentanglement as a second order principle. The first order principle is to systematise associated gas flare governance, before its disentanglement and factoring it into the energy systems transition.

Elite interviewees: I defined elite interviewees as the staff of the units of study if they had ten years of experience or more and were decision-makers. These elites comprised experts, influencers and decision-makers who could practically answer my call to action – to end flaring through increased associated gas use and better governance.

Gas as a bridging energy source: A concept where developing countries accept the status of gas as a transition energy and use it for achieving their decarbonisation (net zero) goals in the interim while planning for more renewable energy sources in the future.

Incremental versus society-wide transformation of climate change actions: Earlier authors have argued that climate action society-wide transformation includes end-to-end change and a circular economy view. I posit that connecting ending flaring to energy consumption but systematising the needed governance as one of goals, instruments and processes to reach minimum viability is a crucial foundational step in end-to-end connection of energy consumption that is suitable for transition to 1.5 Degrees target. This view also drives the need to disentangle energy systems for effective governance.

Leading global associated gas flare governance initiatives and units of action at the global level: By this, I mean international organisations' efforts, leading to initiatives to transform associated gas flare governance, using a multilevel governance approach to deliver sustainability benefits. These global climate initiatives are new non-state actors who appeared in the climate action space and set targets for themselves. For this thesis, they include the World Bank's Global Gas Flare Reduction Partnership and Zero Routine Flaring by 2030; the UNFCCC method number AM0009 for the recovery of gas that would have been vented or flared, the U.S.A Environmental Protection Agency's Global Methane Initiative and the Oil and Gas Climate Initiative – a consortia of 13 top oil and gas companies.

Natural Gas: natural gas is subdivided into associated and non-associated gas with different utilisation rates. Associated gas is found as part of oil extraction and usually re-injected, vented or flared. Non-associated gas, on the other hand, exists in fields and is extracted independent of oil production. The focus of the thesis is on the governance of associated gas flaring with potential applicability to non-associated gas. When I say "gas" I mean both associated and non-associated natural gas and I try to stick to "associated gas" when I refer to the natural gas that is flared by oil companies because of oil extraction.

New governance spaces in hydrocarbon governance: Hydrocarbons include oil coal and natural gas. However, the focus of academic researchers seems to be more on coal and oil. The emerging climate negotiations at COP26 seemed focused on coal alone but the energy price crises in 2021 unravelled this focus to some extent. Thus, I argue that associated gas flare governance which is waste of a natural resource is a problem and deserves mapping as a new governance space. In this new(er) governance space, relational power is as important as governmental power but create complexities which if unpacked leads to better governance.

Policy frameworks and enablers of governance: For this thesis they are (a) knowledge instruments: simple and complex knowledge instruments and knowledge management processes that are prerequisites for (b) effective market instruments as enablers for normative governance instruments. Enablers may also include coherent goals and efficient processes when the exhaustive list of governance instruments are considered (knowledge, market and normative) See systematisation of associated gas flare governance.

Norwegian model: Created by Norway adopted by Nigeria (and other countries) advises separating hydrocarbon governance into three parts of policy, regulatory and commercial functions as processes for better governance.

Politics of hydrocarbon: The politics of hydrocarbon is related to the resource curse where Nigeria like other developing and developed countries sacrifice good initiatives for personal interest from stakes in hydrocarbon resources. In Nigerian the primacy of oil revenue is an important problem. We have this problem because the government wants to earn more oil to export to earn rent – money and this has always been the prime concern – maintaining an exportable surplus of oil to earn revenue. This national stance has allowed international and domestic oil companies to get away with flaring because at the end of the day, the national actions to end flaring can be countered by responses that such actions might reduce the oil companies' ability to produce oil which the country does not want.

Politics of sponsors: I talk about the politics of sponsors and that they want different things, but it could be called the political dimension or matrix which may be why we end up with multiple initiatives doing different things instead of addressing the political challenge/dimension. Instead of using the UNFCCC approach to solve global environmental problems actor end up using the World Bank, a financial development institution based on preferences of politics. The same problem exists in the National and international Civil Service when rivalries in departments and gets in the way of achieving cross-government goals such as Net Zero – in a remarkably juvenile way. The fact that sponsors pay for the initiatives and want different things mean their world views affect how the initiatives are

shaped and their goals rather than the substance of the problem. This means politics of sponsors or political dimension is probably why you have too many initiatives trying to do different/similar things.

Systematisation of associated gas flare governances: Back in 2006 Najam et al., systematised global environmental governance as the sum of actors, their goals, instruments and procedures to protect the environment (Najam et al., 2006). A literature review confirmed a gap for similar systematisation of associated gas flare governance but also an opportunity to extend Najam et al frameworks. I extended the current knowledge of each of the concepts by appending the origins-barriers-influences and solutions approach to the conceptual frameworks. This also covers the definition of the concept of an end-to-end associated gas flare governance systems research.

- **Coherent goals:** associated gas flare governance goals, whatever they are could be systematised as coherent or incoherent and be comprised of (i) steady communication (between co-owners of a problem), (ii) intelligent coordination and (iii) a shared sense of direction (Najam et al., 2006).
- **Effective instruments**: effective governance instrument is about effective (i) knowledge, (ii) market and (iii) normative instruments (Bemelmans-Videc et al., 1998; Paavola, 2007; Oberthür, 2009; Chasek et al., 2011; Bulkeley et al., 2012).
- **Efficient processes**: Processes were already covered in environmental governance literature as interplay (Oberthür, 2009), but my gauging analysis may have led to new insights. I developed three concepts for systemising gas governance processes. I suggested (i) not knowing whom to collaborate with, (ii) lack of capability and (iii) lack of willingness or an enabling environment to collaborate, which I also applied to the global analysis. These processes are examined further in my discussion chapter before proposing new aspects for systematising associated gas flare governance processes.
- **Minimum viable associated gas flare governance system**: A governance system is minimally viable if it has coherent goals, effective instruments and efficient processes The thesis is about critique of policy at an international and national scale – with policy solutions. The thesis defines associated gas flare governance system as comprising of actors, goals, instruments and processes to protect the environment from the harmful effects of flaring, while helping nation-states achieve their aims of ending associated gas flaring from a sustainability perspective**.**

Units of study and calls to action: Academic research delineate units of study as the smallest component of a system to coordinate research or they are referred to as levels of abstraction. My levels of abstraction for this thesis are the global and Nigerian level in which the units of study

exist (as the initiatives and Nigerian governmental organisations and interest groups). I go further by using the units of study as calls to action group because actors from these units contributed to my insights on manifested barriers and targeted policy solutions. This means they have "skin in the game" and are more likely to partake in the further development and implementation of the policy solutions to follow my action research.

Chapter 1 Introduction

1.1 Introduction to chapter one

According to the Intergovernmental Panel on Climate Change (IPCC), we need to disentangle energy systems for the transition that is needed to secure 1.5°C mitigation target (Rogelj et al., 2018). In the disentangled system, we should concurrently consider the challenges and opportunities. However, the IPCC acknowledged gaps in the availability of policy frameworks and enablers needed to deliver the individual system's disentanglement and transformation, even before considering the systems transition.

In addition, the IPCC called for a specific focus on Greenhouse Gas (GHG) emissions from fossil fuel combustion which includes gas flaring (Edenhofer et al., 2014, p. 6-7). However, they acknowledged an increase in GHG from global population growth, economic growth and associated energy consumption. Therefore, climate actions need to be scaled up significantly to deliver the 1.5°C mitigation target. In associated gas flare governance, disentanglement is a second order principle. The first order principle is to systematise associated gas flare governance, before its disentanglement and factoring it into the energy systems transition.

Indeed, there is a "growing imperative for responses to climate change to go beyond incremental adjustments, towards society-wide transformation" (Gillard, et al., 2016, p. 252). Therefore, it may be sensible to focus actions on specific industries and countries with transformative mitigation opportunities such as better associated gas flare governance to deliver climate mitigation targets. To that end, my thesis focuses on an end-to-end-mapping of associated gas flare governance, tracing the manifested barriers and providing prioritised and sequenced policy solutions.

Natural gas (methane) is subdivided into associated and non-associated gas with different utilisation paths. Associated gas is found as part of oil extraction and usually re-injected, vented or flared. Non-associated gas, on the other hand, exists in fields and is extracted independent of oil production. The focus of my thesis is on the governance of associated gas flaring with potential applicability to non-associated gas. When I say "gas" in this thesis, it could mean both associated and non-associated but where possible, I differentiate by saying "associated gas".

There has been considerable research on the oil and coal governance system (Thurber et al., 2011; Holden, 2013; Ramírez-Cendrero and Wirth, 2016; Lund, 2017; Ritchie and Dowlatabadi, 2017).

However, there is a paucity of research on the associated gas flare governance system. There is no end-to-end associated gas flare governance research.

While existing literature cover barriers for flare-out and increased gas use (Mathias and Szklo, 2007; Odumugbo, 2010; Oladipo et al., 2018), these barriers are presented without specific manifestation of root origins and targeted policy solutions. My thesis fills these gaps with end-to-end systems research, building on the existing environment and gas governance literature (Najam et al., 2006; Oberthür, 2009; Odumugbo, 2010; Giwa-Osagie and Ehigiato, 2015).

I argue that an end-to-end associated gas flare governance system research could contribute to achieving transformative mitigation and sustainable development goals (**SDG**). However, the system needs to be mapped and unravelled to gauge its viability. I show the need for a system with coherent goals, an effective combination of knowledge, market and normative instruments and efficient processes. Normative governance or regulation is one aspect of associated gas flare governance, but its effectiveness depends on knowledge and markets as enablers. Besides, associated gas flare governance could be considered ever evolving, meaning exploratory, descriptive and gauging research is needed to contribute to its evolution.

1.2   The Problem statements

We flare associated gas (methane) not only in oil wells but also gas in other industrial processes. We burn methane and turn it into CO_2 – because CO_2 is less damaging than methane but there is also venting of methane happening, which is part of the problem.

The CO_2 consequences of this problem of flaring is at the global and the Nigeria scale. Of course, at the Nigerian scale, the focus is more around the marketisation approach to turning what is currently being set-alight into a resource to deal with energy security, access and quality challenges. The problem is of a different nature globally, to the Nigerian situation.

While these pressures exist at the global level, they are far away enough but real and imminent at the Nigerian level. Therefore, the problems are slightly different between the global and the Nigerian scale, but they are closely related. However, one constant point is increasing global levels of (a) associated gas flaring and (b) gas use creates a contradiction for three reasons.

First, **Figure 1-1** highlights the persistently growing nature of global flaring. Between 2014 and 2019, global flare levels increased by 6.1 billion cubic feet (**b.c.f.**) (Global Gas Flaring Reduction Partnership [**GGFR**], 2020). This increase shows a persistently growing problem, resistant to existing governance efforts.
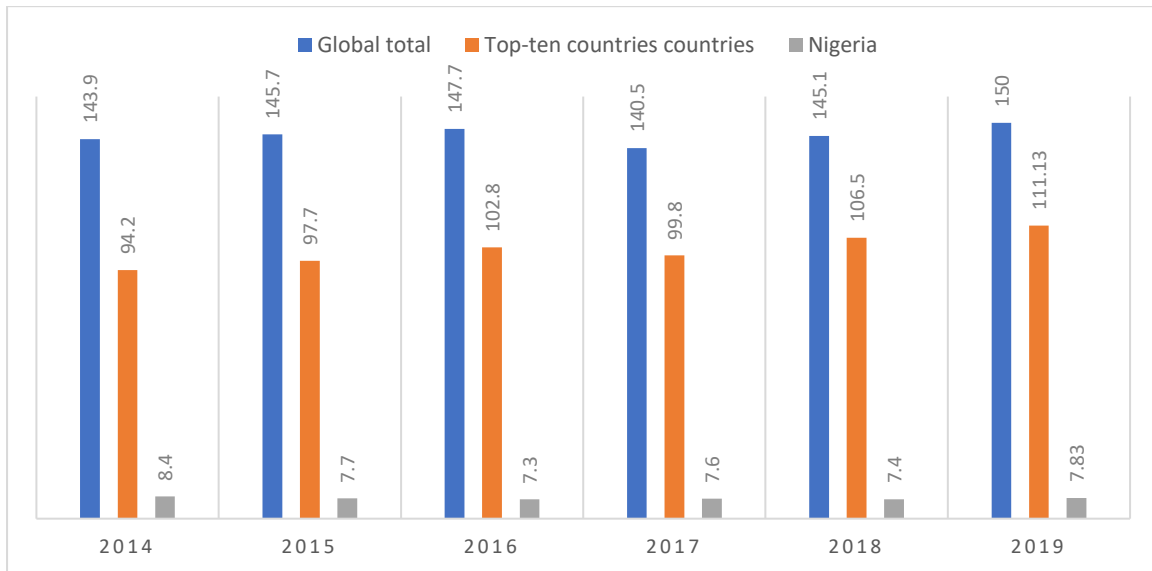
Figure 1-1 Associated gas flare data from 2014-2019; Global and Nigeria – absolute figures in b.c.f

Source: (GGFR, 2020)

Besides, a proportional representation in **Figure 1-2** below shows the top-ten countries' flaring levels increased by at least 9% between 2014 and 2019. Notably, Nigeria's flaring level has stayed below 8 b.c.f since 2015; but accounts for 5.22% of the global problem. Furthermore, while the top-ten countries globally accounted for 65.46% of global flaring in 2014, it was 74.09% as of 2019 (GGFR, 2020). Thus, each year, flaring leads to more than 400 $MtCO_2$ emissions (GGFR, 2020) and this is increasing year and year – highlighting that the current governance arrangements may not be working.
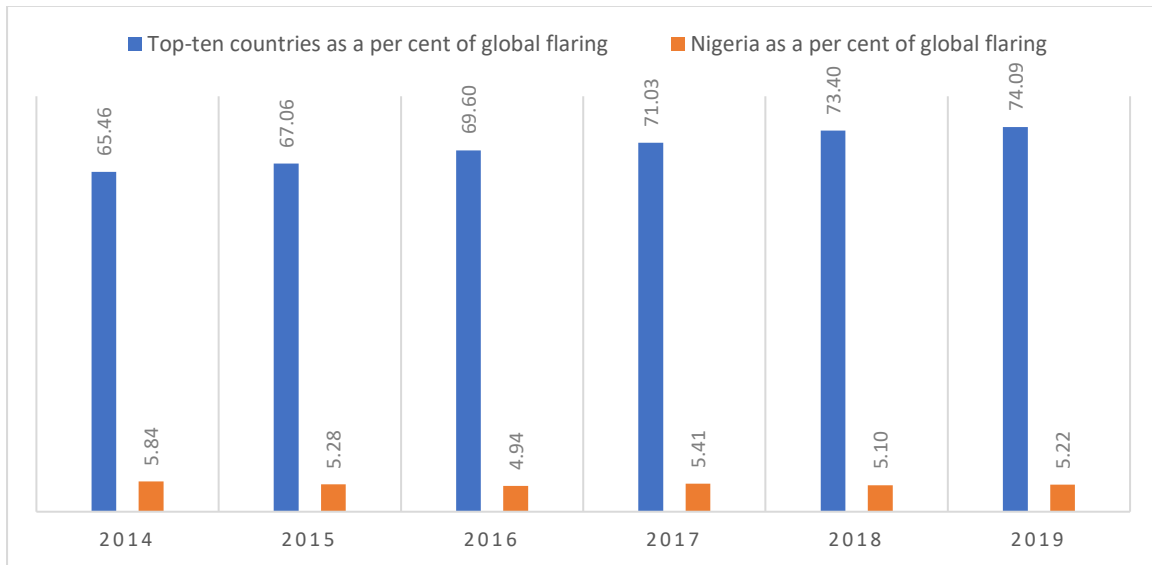
Figure 1-2 Associated gas flare data from 2014-2019; Global and Nigeria – proportional figures

Source: (GGFR, 2020)

Second, as shown in **Figure 1-3**, global gas use increased from 21% to 23% between 2010 and 2019 (International Energy Agency [**IEA**], 2020a). This trend is likely to continue due to the decarbonisation potential of gas (Elvidge et al., 2018; The UK Committee on Climate Change [**CCC**], 2018; Leal et al., 2019). However, as shown in **Figure 1-1** and **Figure 1-2**, global levels of associated gas flaring are increasing and highlights a contradiction.
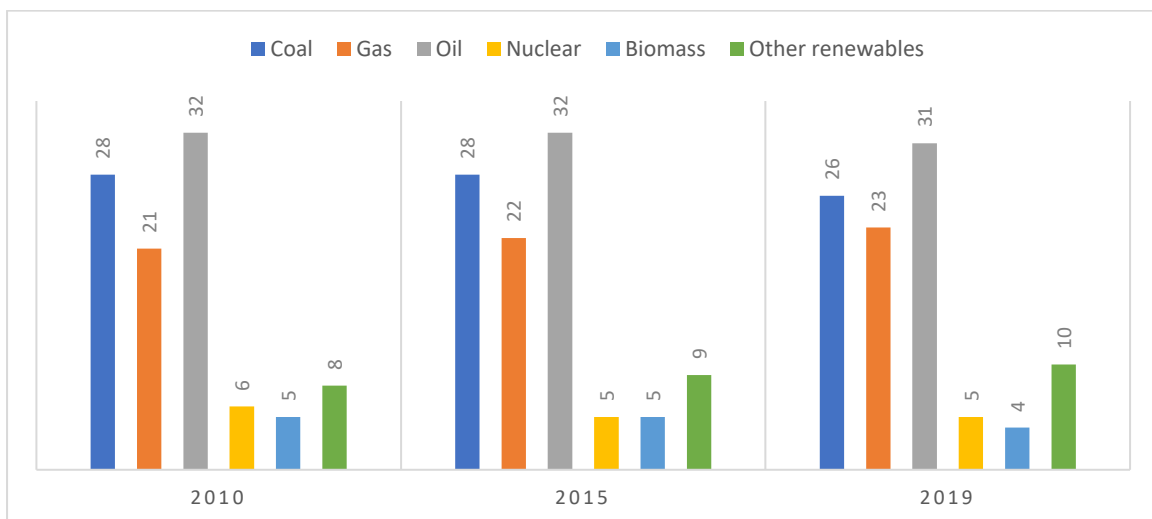
Figure 1-3 Global primary energy demand (2010, 2015 and 2019) by %

Source: (IEA, 2020a)

Third, while there are mixed views on the decarbonisation potential of gas and its status as a transition energy, its global use is a tale of two halves. For example, gas reformation to create blue (not green) hydrogen is a crucial CCC recommendation for the UK's Net Zero strategy (CCC, 2018, pp. 67-69). However, the recommendation assumes full deployment of carbon capture, use and storage (**CCUS**) (pp. 69-70). This approach means developed countries (such as the UK) may view gas as a bridge to decarbonisation, assuming they successfully implement CCUS (McGlade et al., 2018).

While gas could be a bridging energy source for developed countries (i.e., UK) (McGlade et al., 2018; CCC, 2018), it is flared in developing countries (i.e., Nigeria). While developing countries could replace coal-fired power plants with gas-fired turbines, better governance is needed (Edenhofer et al., 2014). Indeed, according to GGFR (2020, p. 4): "if countries used flared gas for gas-to-power, it could generate over 750 billion kWh of electricity annually, exceeding Africa's demand". Therefore, I argue that a global situation where developed countries exploit gas for their energy transition while leaving developing countries with stranded assets – gas reserves and an inability to use it, is a tale of two halves contradiction.

Ending flaring may present developing countries like Nigeria with an opportunity to meet SDG goals among other national priorities. They could build more gas-to-power infrastructures for a lower carbon future while ending associated gas flaring to meet their growing energy consumption. However, while developing countries' energy consumption could increase GHG emissions, it is also likely to enhance existing tension in mitigation debates (Rogelj et al., 2018); especially in COP26 given the timing of this thesis.

1.3 Abstraction levels

I focused my thesis on the global and Nigerian national abstraction levels.

At the global level, I am trying to systematise an associated gas flare governance which covers many countries and actors with sovereignty and political implications. Pictorially this is the horizontal view. At the Nigerian level I am trying to systematise the same governance but with a nuance of associated gas flare commercialisation, competing pressures of growing population, desire for economic growth, meeting climate targets and providing energy access and security among others. Pictorially, this is the vertical view.

International development organisations mainly govern associated gas flaring through global cooperative climate initiatives to solve what they see as a collective problem for collective benefits. Thus, systematising the global associated gas flare governance could fill gaps in our knowledge of their policy framework and enablers for transformative governance (Edenhofer et al., 2014; Gillard, et al., 2016).

Nigeria makes a good country case study for the second abstraction level for three reasons. First, it has a proven gas reserve of 200.4 trillion cubic feet but flares between 7 to 8 b.c.f of associated gas annually, 5% of the global problem (GGFR, 2020). Second, Nigerians suffer from a lack of basic energy access; over 70 million and 150 million have no access to electricity or clean cooking facilities (IEA, 2020b). Third, Nigeria could become the third most populous country by 2050 (UN, 2017) with a growing energy consumption gap.

Nigeria currently tackles flaring through regulation, market approaches (associated gas commercialisation) and Nationally Determined Contribution (**NDC**). NDCs are Paris Agreement commitments by countries to reduce national emissions. Therefore, mapping Nigeria's associated gas governance arrangement could fill gaps in knowledge of policy framework and enablers for transformative governance (Rogelj et al., 2018).

The global level is important because flaring does not happen in a vacuum and global actors can support and influence better national governance of a global problem such as flaring of associated gas. Nigeria is important because it accounts for 5% of global associated gas flaring problem, has 70m people without access to electricity and 150m without access to clean cooking energy and owns the associated gas that is flared. While other levels such as corporate, project and community levels of abstraction could be important, I did not have the resources to conduct the research at these levels but recommend them for further research in **section 8.4.2**.

1.4   Objects of research

I searched Google, Science Direct, Emerald and Taylor & Francis Online to create my objects of research. Then, I selected articles for analysis if they led to added insights. The four objects of the research are (1) climate change mitigation and GHG emission, (2) energy security, (3) oil and gas industry, (4) multilevel policy and governance interventions (**Figure 1-4**). From the search and initial review of literature I was able to decide that governing associated gas flaring could be considered a complex policy framework (Head and Alford, 2013) and worthy of doctoral research for three reasons.

First, one of the main policy recommendations of the IPCC was to apply a transformation focus on climate change mitigation towards large scale energy systems (Edenhofer et al., 2014). While host countries and oil companies make investments to use it, flaring continues due to policy, regulatory, economic and technical barriers. Therefore, associated gas flare governance is an *oil and gas industry challenge* but due to *multiple barriers. However, we* need to know more about specific barriers to devise targeted solutions.

Second, a significant source of increasing GHG leading to climate change is from associated gas flaring (Edenhofer et al., 2014). Therefore, flaring is a *climate change* and *GHG emission reduction* problem. Effective associated gas flare governance is a potential solution that requires an increased understanding of policy frameworks and enablers. The proposition assumes we can map the barriers and solutions for a better associated gas flare governance system and the solutions are pragmatic and acceptable to multiple actors (Valentine et al., 2017).

Third, although potentially a primary energy source, associated gas is wastage through flaring. I assume countries who flare could economically use the flared gas for power generation or other economic endeavours. However, the global north trend of purportedly divesting from fossil fuel complicates this assumption. Therefore, governance that reduces flaring and increases gas utilisation could *reduce GHG emission*s and tackle *energy security challenges*, but it must do so in a way acceptable to Nigeria as an owner of the associated gas. I make a case for expanding the vertical view of associated gas flare governance to cover similar countries in the top-ten league of flarers.

Therefore, associated gas flare governance is a multi-level problem requiring systematisation.
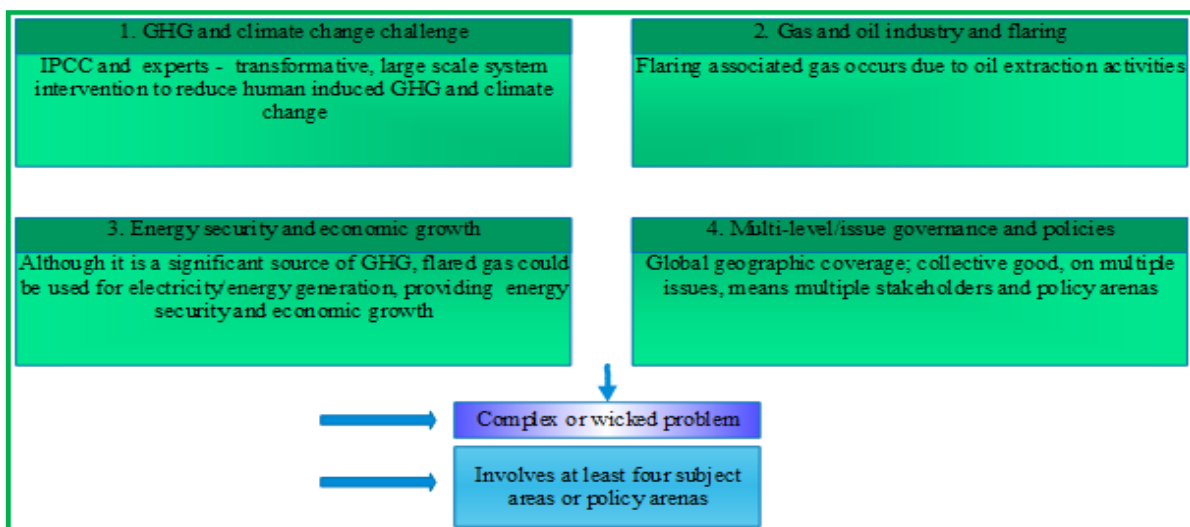
Figure 1-4 The complex policy problem of associated gas flare governance

Source: Author

1.5   Aim, questions, objectives and originality

The preceding led to my research aim to systematise global and Nigerian associated gas flare governance as an end-to-end system, surfacing any gaps in minimum viability, with policy solutions. To meet this aim, the thesis answers three questions with nine objectives:

- **Research question 1 (answered in Chapter 4)**: how could the global and Nigerian associated gas flare governance be systematised?
    - o   **Research objective 1**: to develop a conceptual framework for systematising global and Nigerian associated gas flare governance.
    - o   **Research objective 2**: to systematise (a) global and (b) Nigerian associated gas flare governance.
    - o   **Research objective 3**: (a) to chart the emerging barriers to the systematised global and Nigerian associated gas flare governance and (b) assess the viability (after charting the barriers to a systematised global and Nigerian associated gas flare governance).
- **Research question 2 (answered in Chapter 5)**: what are the manifested barriers, origins for the systematised global and Nigerian gas flare governance?
    - o   **Research objective 4**: to trace manifested barriers and origins for the systematised (a) global and (b) Nigerian associated gas flare governance.
    - o   **Research objective 5**: to determine the significant barriers and their root origins at the (a) global and (b) Nigerian levels.
    - o   **Research objective 6**: to assess the viability of the global and Nigerian associated gas flare governance systems based on the manifested barriers and origins.
- **Research question 3 (answered in Chapter 6)**: what are the policy solutions for the barriers and origins to the systematised global and Nigerian associated gas flare governance?
    - o   **Research objective 7**: to devise solutions to the manifested barriers and origins for the systematised (a) global and (b) Nigerian associated gas flare governance.
    - o   **Research objective 8**: to determine the sequencing and prioritisation of the policy solutions for the systematised (a) global and (b) Nigerian associated gas flare governance.
    - o   **Research objective 9**: to assess the viability of the systematised (a) global and (b) Nigerian associated gas flare governance after application of policy solutions.

Like environmental governance, associated gas flare governance could better recognise nation-based solutions for critical interventions (Paavola, 2011). Therefore, I applied a global and Nigerian systematisation-barriers-solutions perspectives for research that is socially relevant to policymakers and academics but implementation ready as outlined in **Figure 1-5**.

First, I created conceptual frameworks to systematise the global and Nigerian associated gas flare governance and highlighted emerging barriers to the systems viability. Second, I traced the emerging barriers to their manifestation and highlighted their significance, origins and root origins to the manifested barriers. Third, I devised policy solutions which are sequenced for implementation but also targeted at significant barriers and root origins where possible.

We need more social science-based climate change mitigation research) to combine environmental and social goals for a just transition (Fankhauser, 2019. These debates are ongoing in COP26 s. This thesis fills the knowledge gaps of the associated gas flare governance policy framework and enablers by highlighting why more connected systems are necessary and how we could design these systems.
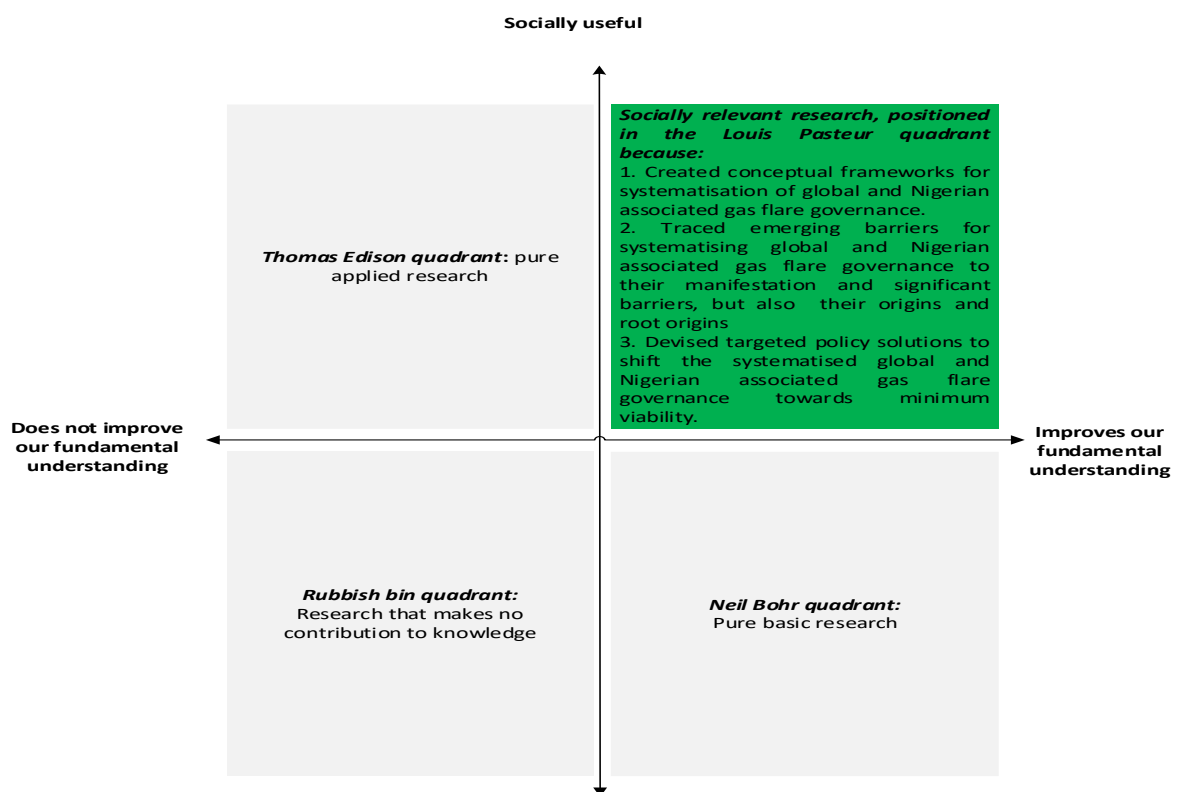
Figure 1-5 Originality – advancing associated gas flare governance knowledge to end flaring

Source: Modified from Stern et al. (2016); Sovacool et al. (2018); Klahr (2019)

1.6 Structure and outline of the thesis

This chapter introduced the thesis and the outline of the remaining chapters now follows. **Chapter 2** contextualises the research in the relevant literature. **0** sets out how the research questions are operationalised and answered. **Chapter 4** to **Chapter 6** are the results, evidencing the end-to-end systematisation of associated gas flare governance.

Chapter 4 is a descriptive and based on document analysis that systematises associated gas flare governance at the global and Nigerian abstraction levels and uncovers emerging barriers. This chapter captures the results of my first attempt at systematising the governance of associated gas flaring. The systematisation evidenced incoherent goals, ineffective instruments and inefficient processes due to 11 emerging barriers.

Error! Reference source not found. traces the 11 emerging barriers, their manifestation, significance and root origins. It captures the results of my second attempt at systematising the governance of associated gas flaring. I interviewed 11 global actors and 19 Nigerian elite interviewees to confirm, refute or shed more light on the 11 emerging barriers that potentially constrained the global and Nigerian systems from attaining minimum viability.

Chapter 6 also used 11 global and 19 Nigerian elite interviews to supply policy solutions targeted at (mainly) significant barriers and root origins but offer policy solutions. Due to root origins like the politics of sponsors, politics of hydrocarbon/lack of primary legislation at the global and Nigerian level, some solutions cannot be implemented in the near term. However, there are simple solutions which strategic and operational managers in the units of action could implement without tackling the root origins.

The last two chapters engage with the literature and conclude the thesis. **0** discusses the key insights and uses a cross-case evaluation approach to consolidate the results and engage with the literature. **Finally, Chapter 8** concludes the thesis.

Chapter 2   Literature review

2.1   Introduction to chapter two

There have been calls for research that connects SDGs to gas governance and climate action (The United Nations (UN), 2011). For example, Van Alstine et al. (2014) called for mapping new spaces in hydrocarbon governance. Also, Gillard et al. (2016, p. 252) posited that "it is critical to go beyond incremental climate action and aim for society-wide transformation". I answer these calls by connecting SGD to associated gas flare governance.

While researchers studied environmental governance as an end-to-end system, there are no similar studies for associated gas flare governance. The literature review that follows shows a simple but critical gap, that there is no end-to-end research that covers the systematisation of associated gas flare governance. In addition, there are no research that traces associated gas flare governance barriers to their root origin and provide policy solutions as my thesis does.

While there is an initial heavy emphasis on global environmental governance literature in my review, I have chosen not to locate my thesis in any discipline or theory. Instead, I borrowed from environmental governance and developed applicable conceptual frameworks to systematise associated gas flare governance. The nature of my research is cross disciplinary, and I am not driven by theory but by the problem identification and solutions. My thesis is about critique of policy at a global and Nigeria scale and provides a solutions-driven way forward.

The review covers current attempts at systematisation of associated gas governance in **section 2.2**. It is then followed by literature review on barriers to associated gas flare governance **section 2.3**. Then, **sections 2.4** outlines a limited solutions-focused literature. Due to the paucity of associated gas specific end-to-end research, environmental governance literatures were extensively used. **Section 2.5** outline the units of study for a call to action and the gaps in literature. I linked each section to specific research questions to strengthen the golden threads of my research. Finally, s**ection 2.6** summarises the chapter.

2.2   Developments on systematisation of associated flare governance

There is a simple gap, a lack of end-to-end research to systematise associated gas governance.

Najam et al.'s articulation of global environmental governance sets this thesis's overall conceptual framework. In an environmental governance report, Najam et al. (2006, p.1) defined it as "the sum of organisation's goals, instruments, rules, procedures, and norms to protect the environment". However, to the best of my knowledge, there is no similar definition of global associated gas flare governance. Thus, while it is possible to define global and Nigerian associated gas flare governance as a system, research is needed.

I unpack the above definition to show three connections in Error! Reference source not found.. First, I operationalise Najam et al.'s definition to systematise associated gas flare governance. Second, I show how exploratory research may enable a systematisation of associated gas flare governance. Third, I propose a way of gauging the system's viability for coherent goals, effective instruments and efficient processes and proffer solutions.

Table 2-1 Initial academic literature review and linkages

Conceptual framework	Global and Nigerian associated gas flare governance is an emerging space comprised of goals, instruments and processes.
	Global and Nigerian associated gas flare governance could be described as a connected or connectable system comprised of national subsets.
Goals	Exploratory research maps the global climate initiatives (Fenhann et al., 2018; Morrison et al., 2019) and Nigerian governmental organisations and their associated gas flare governance goals but surfaces specific barriers for goal coherence and targeted solutions.
Instruments	Exploratory research maps the global and Nigerian associated gas flare governance instruments (Bemelmans-Videc et al., 1998; Paavola, 2007; Oberthür, 2009) but surfaces specific barriers for effective instrument and targeted solutions.
Processes	Exploratory research maps the global and Nigerian associated gas flare governance processes (Oberthür, 2009; Bulkeley et al., 2012; Hale and Roger, 2013) but surfaces specific barriers for efficient processes and targeted solutions.

Source: *Author, modified from multiple journal articles.*

2.2.1   Goals in systematisation of associated gas flare governance

This section of the literature review captures insights from developments to systematise goals in broader environmental and associated gas flare governance.

Najam et al.'s concept of global environmental governance (2006) is applied to set the scene. The thesis also embraces the idea of global cooperative initiatives as emerging coordinators of global climate action (Fenhann et al., 2018).

Goal coherence has three parts: steady communication, intelligent coordination, and a sense of mutual direction among actors governing a collective problem (Najam et al., 2006). However, we do not know enough of the global and Nigerian national associated gas flare governance, a gap which this thesis tackles.

Fenhann et al. (2018) applied an impact framework to study the performance of global climate cooperatives. The authors concluded that "we are indebted to the integrity of the UNFCCC process to ensure the initiatives achieve the targets they set themselves" (p. 15). Indeed, assessing the coherence of associated gas flare governance goals could be crucial in creating confidence in the integrity of the new global initiatives. However, the governance arrangements need to be systematised before goals can be effectively assessed for coherence.

Furthermore, we know that there is no one-size-fits-all type of goals. There is also a black box situation in multilevel environmental governance goals (Morrison et al., 2019). However, we do not know enough of global and Nigerian associated gas flare governance goals, how they specifically tackle flaring, and whether they are coherent.

Notably, goal specificity may be essential in governance goals, but there are multiple views of the value of specificity. For example, Morrison et al. (2019) concluded that specific goals could enable better progress. Nevertheless, political reality might mean sacrificing specificity for collaboration (Omri and Mabrouk, 2020). Collaboration is more likely to lead to generalisation (Biddle and Koontz, 2014). However, generalisation could translate to a lack of specific focus on associated gas flaring instead leading to increased gas consumption or worse still increased flaring.

Assuming the complexity of the politics of sponsors was not a constraint in environmental governance, many initiatives could collaborate to form more advocacy groups of shared interest than currently

exist (Rosenbloom, 2018; Dellmuth and Bloodgood, 2019). However, discursive dynamics (Beunen and Patterson, 2016; Morrison et al., 2019), lead to what I refer to as discursive switching. Discursive switching is where degrees of ambiguity and scope allow for a more suitable interpretation by actors of what is expected of them. This means powerful actors pick and choose interpretations and contestations of debates in climate change mitigation. Moreover, the application of framing and discursive switching by more powerful actors could be a barrier to collaboration (Beunen and Patterson, 2016; Morrison et al., 2019).

The multiplicity of actors leads to interactions based on similar views and strategic action fields (Fligstein and McAdam, 2015). In designing goals, options could be bounded by limitations such as scope and whom to engage with, leading to the need to consider the strategic field of action. Besides, the initiative's mandate, available resources and size determine its adoption of specialist or generalist goals (Dellmuth and Bloodgood, 2019). Therefore, my thesis considers the impact of these limitations in gauging goal coherence.

Rosenbloom (2018) applied the politics of transition through a discursive study on the phase-out of coal in Ontario, Canada, with three relevant findings for associated gas flare governance. First, there is a continuing struggle between contending actors, where the interest of stronger actors prevails. Second, regulatory approaches could accelerate progress when markets do not provide politically acceptable solutions. Thus, while regulation is essential, markets and knowledge instruments are enablers. Third, discursive switching mark framing struggles between contending actors, leading to slower progress, which may also apply to gas governance.

We know that actors exert three types of power in formulating environmental governance goals: design, pragmatism and framing, leading to adverse outcomes (Beunen and Patterson, 2016; Morrison et al., 2019). Exertion of power could explain adverse outcomes when stronger actors apply design pragmatism and discursive switching to achieve whatever works for their constituents (Morrison et al., 2019).

We are on the transition to net zero, and the role of gas needs to more apparent. Gas could be a bridge to net zero for developed countries, assuming they get the associated solutions such as CCUS right (McGlade et al., 2018). However, it is a different story for developing countries, meaning there may be tensions in global positions. Besides, generalisation, specialisation, discursive switching and exertion of power could be weakening associated gas flare reduction debates.

Without clear goals, steady communication of these goals, intelligent coordination, global and Nigerian associated gas governance actors stand little chance of achieving shared sense of direction. This thesis unpacks the black box of associated gas flare governance by systemising the goals. It also highlights specific barriers and provides policy solutions. Next, the thesis examines the literature on systematisation of environmental governance instruments and their applicability to associated gas flare governance.

2.2.2   Instruments in systematisation of associated flare governance

This section of the literature review helps frame our understanding of associated gas flare governance instruments and barriers and contribute to the solutions. Gas is a primary energy source that plays a crucial role for developed and developing countries to meet their climate change commitments. However, it seems the contradiction of using gas for creating hydrogen (developed countries) and for primary energy (developing countries) could continue for differentiated reasons.

For example, Brazil built gas into its strategic energy mix (Fernando et al., 2019). Cyprus chose gas as its primary energy source to meet the EU Environmental Protection requirement regulation (Mesimeris and Partasides, 2020). As a developed G7 economy, the UK depends on gas to deliver its fifth carbon budget and work towards net zero (CCC, 2018). These three examples (the UK, Brazil and Cyprus, *but later Nigeria*) are not even among the twenty countries that have linked their NDC commitments to better use of associated gas (Elvidge et al., 2018). Thus, we can see the importance of gas as a decarbonisation energy source.

The literature review shows that in broader global environmental governance, there are three types of instruments as (a) knowledge and (b) market, which are enablers for good behaviour and could function as precursors for (c) normative instruments (Bemelmans-Videc et al., 1998; Paavola, 2007; Oberthür, 2009). While we know how the three instruments work in environmental governance, we do not have similar knowledge of associated gas flare governance.

For example, we know that in environmental governance older global initiatives prefer market instruments while newer ones prefer normative instruments (Bulkeley et al., 2012). Each of the three instruments is defined and considered in turn, examining the environmental governance literature and their applicability to associated gas flare governance.

Knowledge instruments

In environmental governance, knowledge instruments use information to reduce cognitive costs and change behaviour; they could be simple or complex (Oberthür, 2009; Chasek et al., 2011). Simple instruments include best practices, guidance, gathering and publishing information, and complex instruments include knowledge platforms, networks and knowledge transfer mechanisms.

Effective knowledge instruments require the progressive application of four knowledge management processes: (a) internal knowledge development, (b) acquiring external knowledge, (c) storing knowledge but most importantly (d) knowledge transfer to achieve governance goals (Chasek et al., 2011). Better knowledge management could allow the transfer of best practices between the global and national levels and vice versa.

Strong horizontal knowledge management at the global level leads to the codification of best practices, storage/retrieval and transfer for vertical application by the national level. So does vertical and horizontal knowledge transfer from the national level to facilitate impactful policymaking and options.

However, we cannot assume national-level application of global governance knowledge or vice-versa. Therefore, creating internal knowledge or acquiring external associated gas flare governance knowledge is critical and systematised in this thesis.

Market instruments

In environmental governance, market instruments involve economic-based arguments to influence behaviour and rely on supply-demand interaction (Bemelmans-Videc et al., 1998; Oberthür, 2009). Therefore, it is conceivable that actors artificially create the supply-demand for market instruments. One could argue the same for all market instruments. For example, in associated flare gas governance, market instruments could include incentives, access to carbon markets and other means of improving the economics of flare-reduction (deciding what to do with gas).

However, flare-reduction through increase associated gas use for energy generation would come at a considerable cost. While project sponsors could reduce investment risk through climate finance, market failures limit their use (Giwa-Osagie and Ehigiato, 2015).

Stern supplies an authoritative view that "climate change is the biggest externality the world has ever seen" (Stern, 2006, p. viii). Stern's view could mean market forces may fail in distributing the external cost of climate change mitigation. However, for over a decade, the World Bank reported on the "State and trend of carbon markets". They continue to make a case for a market, despite their admission that:

> The total value of the global carbon market stalled at $142 billion. Suffering from the lack of post-2012 regulatory clarity, the value of the primary Clean Development Mechanism (CDM) market fell by double-digits for the third year in a row, ending lower than it was in 2005, the first year of the Kyoto protocol (World Bank, 2020).

Aside from the externality, we need to further explore the connections of carbon markets to associated gas flare governance through NDC and conditional mitigation targets (Elvidge et al., 2018). For example, there could be gaps in how gas-flare countries plan to realise NDC targets through carbon markets if the artificially induced markets fail to mature. Such artificial gaps have existed in earlier carbon-market instruments.

Notably, the UNFCCC method number AM0009 connects associated gas flaring reduction to the carbon market. Therefore, it is possible to extend this research to the CDM, examining the role of climate change policies and access to climate finance. In this case, the relevant instrument may be the UNFCCC AM0009 for capturing and using associated gas - that would otherwise be vented or flared. First, however, its effectiveness as an associated gas-market instrument needs to be examined.

The UNFCCC AM0009 is not a self-standing initiative. Instead, it is a tool developed for CDM projects in countries looking to reduce flaring. This thesis considers the CDM angle by analysing key barriers because of the supply and demand imbalance of CDM AM0009 carbon credits in the market- and knowledge-led governance. Therefore, this study analyses Nigeria's climate change policies, highlighting barriers and solutions.

Normative instruments

Normative instruments for environmental governance include norms, standards and rules to change behaviours and achieve goals. They rely on (1) a hierarchical command and control system, (2) hard targets and (3) standard-setting mechanisms (Bemelmans-Videc et al., 1998; Paavola, 2007; Oberthür, 2009). Notably, consistency of design and applicability may be a challenge.

For example, in a study on reconceptualising environmental governance, Paavola (2007) suggested excluding non-conforming users through regulation. However, Oberthür (2009) found a reluctance of global environmental organisations to use normative governance instruments, even though it was in their nature to create and use norms and standards. While the environmental governance literature has considered standard setting as a normative instrument, it could also be a precursor to norms that lead to consistency in governance.

Notably, there is an abundance of standards to deal with GHG from the gas sector at company and project levels. For example, at least six Global Organisation standards enable assessing and verifying GHG emissions (ISO-Environment, 2019). Aside from the ISO 1406 series, there are three other standards related to GHG from the gas and oil sector: (a) The Task Force on Climate-Related Financial Disclosures (TCFD, 2021), (b) Global Reporting Initiative (GRI, 2021) and (c) Climate Disclosure Framework (CDP, 2021). Besides, the UNFCCC AM0009 is also a standard for the gas and oil sector. It enables countries and project sponsors to access climate finance in flare-out projects (UNFCCC, 2013). However, the deployment of norms and standards may not be consistent.

In associated gas flare governance, there could be a similar reluctance to apply normative instruments. Therefore, there could be an abundance of normative instruments to enable better governance to reduce flaring, which are not effectively applied. This thesis looks at the design and applicability of normative instruments of associated gas flare governance at global and Nigerian national levels.

2.2.3 Processes in systematisation of associated flare governance

The insights in this section help frame our understanding of environmental governance processes. Like goals and instruments, this section considers their applicability to associated gas flare governance.

Oberthür (2009) extensively researched environmental governance processes (referred to as interplay), which led to four processes. The first is an overarching global environmental organisation, responsible for global decision making. The second, a partnership, involves horizontal and vertical collaboration, emphasising both, leading to clustering. The third is an independent process that focuses on vertical coordination with less horizontal coordination. The fourth is autonomous working.

Notably, we can discount the idea of an overarching global organisation due to the multiplicities of stakes and lack of world political authority (Perrez, 2006; Oberthür, 2009) and the need to apply specific mosaic solutions (Paavola, 2011). Furthermore, the nature of governing multi-issue problems

means we can discount the idea of autonomous working. Thus, I focus on partnership and independent processes and their applicability to associated gas flare governance, on the premises of an assumed minimum collaborative nature.

Recognising the role of processes in environmental governance, Hale and Rogers (2013) extended the work of Bulkeley et al. (2012), focusing on the World Bank and the UK. They found orchestration was a new way of achieving progress. Orchestration is when stronger actors convene others to drive progress from climate deadlocks. Climate deadlock occurs when stakeholders with varying interests but differing power disagree on mitigation goals (Shaw, 2011).

However, climate deadlock is worsened by a passive acceptance of lack of collaboration (Najam et al., 2006; Oberthür, 2009; Bulkeley et al., 2012; Hale and Roger, 2014). We may argue that collaboration leads to progress at the pace of the slowest actor. However, a lack of collaboration may mean we do not secure GHG reduction at the scale and speed needed for a 1.5°C mitigation pathway. One aspect of the problem is related to the definition of time horizons and impact. Whereas global political cycles are five years, most climate change-related interventions are far more long term (although inexorably reducing).

From the above, we know of partnership and independent working as practical governance processes. We also know of orchestration as a way of breaking climate deadlocks. However, we may not know enough about their development and application to associated gas flare governance at the global and Nigerian abstraction levels. For example, we may not know enough of how global associated gas flare governance processes are designed and applied. Furthermore, while we know Nigeria's NDC is ambitious and associated gas plays a critical role, we do not know how Nigeria coordinates associated gas flare governance processes. Besides, we do not know how gaps in processes may lead to barriers. This thesis covers the gap by describing global and Nigerian associated gas flare governance processes.

2.3 Developments on systematisation of barriers for associated gas flare governance

2.3.1 Barriers for coherent associated gas flare governance goals

The literature review highlighted two policy frameworks for mapping barriers to coherent goals to end associated gas flaring (Wood et al., 2012; Ajugwo, 2013; Giwa-Osagie and Ehigiato, 2015; Mitchell and

Marcel, 2015; Colombo et al., 2016). The first separated stakeholder roles and interests. The second used a view of joint stakeholder roles, like financing and implementation.

This thesis follows the second approach. It considers reducing flaring, financing and project execution a complex policy framework and an output of relational power and governance (Grimble and Wellard, 1997; Mitchell et al., 1997; André et al., 2012). For example, the World Bank finances flare-out projects. It expects GGFR to use relational power to govern gas; as a new governance space (Arts and Tatenhove, 2004; Capano et al., 2015). Another example is the collaboration between UNFCCC CDM AM0009 and the Designated National Authorities at the country level to govern gas through climate finance. See Error! Reference source not found.**.**

Global and Nigerian Stakeholders	(1) Private / Public Financing Institution	(2) Creators and users of carbon market instrument i.e AM0009	(3) Host country of a CDM AM0009 project and DNA	(4) Gas and oil companies with associated gas assets and liabilities	(5) Entity with interest and resources to use associated gas
What is their interest? **Goals**	Institutionalisation of power, legitimacy, power, design and framing		Economic growth, energy security and meeting Nationally Determined Contribution targets		
	Reduction of GHG emission, climate change mitigation and transformational change		Access to finance, economic returns, guaranteed income and market stability		
What do they do? **Instruments and processes**	Sponsor, and or finance and or de-risk associated gas flare reduction project or special purpose vehicle				
	Build associated gas flare reduction plants		Operate associated gas flare reduction plants		
	Influence associated gas consumer to participate and use associated gas for Combined Cycle Gas Turbine electricity and other use				

Figure 2-1 Joint stakeholder roles and interest in ending associated gas flaring

As highlighted above (Error! Reference source not found.**)**, global actors collaborate with national actors to realise their goals. For example, development financing organisations and aggregated gas

consumers provide a market price guarantee to reduce risk (Verdeil et al., 2015). In addition, the gas and oil companies and banks are sponsors with equity investments who set up special purpose companies or flare-out projects. Other stakeholders in a flare-out policy framework include environmental lobbyists, regulators and global/local environmental stakeholders.

Graaf and Colgan (2016) developed an expansive view of energy security governance, highlighting multiple areas requiring specific governance systems. However, stakeholders' roles are not prescriptive. Besides, goals are co-mingled, meaning stakeholders need to advocate and use soft power to govern to institutionalise power (Dellmuth and Bloodgood, 2019). Through this process, they also secure legitimacy, economic growth, energy security, deliver NDC targets, and access climate and development finance.

2.3.2   Barriers for effective associated gas flare governance instruments

Academic researchers have found various barriers to associated gas use; however, specificity of the barriers and targeted policy solutions is a gap this thesis covers.

At the global level, Wood et al. (2012) considered associated gas monetisation routes. They found that barriers included high investment cost, complex processes and an unattractive value chain. The authors concluded that stricter regulation could tackle markets' challenges and make the value chain more attractive, leading to greater monetisation of associated gas. The environmental governance level literature also shows that stricter regulation is needed.

Banerjee and Toledano (2016) developed more targeted research for goals to increase the use of associated gas at country and sub-national levels. Banerjee and Toledano's study reflected three related issues: ending the economic waste, improving environmental/health quality and energy security. Their recommendations included delegating regulatory oversight to a single regulator, prohibitive sanctions, and allowing flaring in exceptional circumstances; already covered by the World Bank's best practice codification (World Bank, 2004; 2009). Therefore, there could be further consideration of the global level role in shaping nation-state level associated gas flare governance. This thesis takes a global and Nigerian approach from the first principle, but in a connected way.

This thesis also builds on the work of Banerjee and Toledano in three ways.

First, the authors potentially missed the interconnectivity in global associated gas flare governance goals and the role of global actors – the units of study and calls to actions fills this gap. Second, in covering 12 countries and two American states, the authors may have sacrificed depth for breadth in analysing associated gas flare governance goals. This thesis covers global actors and goes in-depth into the Nigerian associated gas flare governance system. Third, they encouraged the use of markets and the value chain to drive good behaviour. This thesis looks at knowledge, market and regulatory instruments in-depth at the global and Nigerian level. In addition, Banerjee and Toledano's study which seemed focused on processes could be improved with further detailed systematisation of governance instruments and goals.

Nwanya (2011) studied the challenges in increased associated gas use at the Nigerian level by assessing micro gas-fired turbines' comparative benefits. The author found that over 2040 MJ of firewood is consumed annually for energy. However, this is also alongside annual flaring of close to 10 b.c.f of gas. Recent developments, such as conditionality clauses in NDC from the Paris Agreement linked to ending flaring in Nigeria (UNFCCC, 2015) and Nigeria's national statement at COP26 which promises the use of associated gas until 2040, show a degree of certainty in the author's prediction. Perhaps it is time to come to terms with gas's role in climate change mitigation in the short to medium term.

Buzcu-Guven and Harriss (2012) supplied added insight to better governance for alternative use of associated gas. The authors used extensive document analysis to argue for accelerating flare-out by working with countries with the required collaboration capabilities. Adewuyi et al. (2020) recommended that Nigeria learn from other countries to use its gas resources better. The authors used Nigeria's proven gas reserve, coupled with energy security challenges and economic growth, as a rallying cry to end flaring and meet SDGs. In addition, they supplied helpful recommendations such as ensuring proper incentive mechanisms, developing capabilities and penalties.

It is nevertheless still unclear how to systematically describe what is there and what could enable better associated gas flare governance. However, a "**minimum viable associated gas flare governance system**" is needed like that which was defined for environment governance (Najam et al. 2006). A minimum viable associated gas governance system could comprise coherent goals and effective instruments, and efficient processes to enable better associated gas flare governance. Therefore, this thesis assesses the effectiveness of the global and Nigeria's associated gas flare governance instruments, but also coherence of goals and efficiency of processes.

Mitchel et al. (2015) looked at contemporary developments affecting investments in the oil and gas sector from a global perspective. The authors concluded that if enough countries adopted more robust climate policies, this would negatively impact infrastructure investments in the oil and gas industry. The authors also predicted that while the Paris Agreement may not lead to more robust climate policies, later rounds of climate negotiations could. This prediction seems to be playing out in the build-up to COP26. For example, the UK divests overseas fossil fuel investment (OECD, 2019; Gov.UK, 2020).

Giwa-Osagie and Ehigiato (2015) analysed financing options in the Nigerian oil and gas sector; they laid out different options for corporate entities and Nigeria as a nation-state. The authors concluded that two main challenges included an expensive and complex financing process and a lack of capital provisions in Nigeria's budgets to invest in infrastructures. Without tackling knowledge deficits such as transparency in ownership of infrastructures, regulatory and market signals and transparent commercial arrangements, gas infrastructure financing in Nigeria could remain expensive and complex. This thesis examines adopting best practices, such as those from the World Bank, through the three lenses of knowledge, market as enablers for financing, creating and implementing normative-based instruments.

Although the international financing organisations' role in offering partial risk guarantees for associated gas infrastructure projects is essential, the emerging issues of conditionalities in NDCs and climate change plans make this a negotiation tool. Countries like Nigeria have created heavily weighted gas dependent NDCs, so it is unlikely the fossil fuel reliance problem will disappear. This thesis looks at market-enabling instruments of associated gas flare governance, including market financing, but in the context of how market instruments could be made more effective if they are to contribute to realising NDC targets.

Ajugwo (2013) drew alarming conclusions and posited that Nigerian associated gas flare governmental organisations' reluctance to enforce compliance, coupled with a low penalty, were crucial barriers. While the literature reviewed looked at increasing the effectiveness of normative governance instruments, there seems to be relatively little focus on the enablers (knowledge and market instruments) (Ajugwo, 2013; Orji, 2014; Nwapi, 2020).

For example, Nigeria's past flare-out initiatives may have failed due to a lack of legislation and high reliance on oil revenue (Orji, 2014). As an extension, Nwapi (2020) applied a regulatory assessment framework (developed for the Alberta Energy Regulator) to analyse Nigeria's National Gas Policy of

2017. The author concluded that significant gaps in the regulatory environment meant a low chance of success. This thesis focuses on the 2017 gas policy and finds similar results but specific manifestations of the barriers and offers targeted policy solutions.

Calel and Mahdavi (2020) also looked at the potential for unintended consequences in flare regulation leading to direct venting of methane, with a more significant climate change impact. They concluded that ending flaring is a multi-task problem. New technologies could enable tracking and enforcing flare reduction while tracking potential shifts to direct venting.

Knowledge and markets instruments are enablers for normative instruments (Bemelmans-Videc et al., 1998; Chasek et al., 2011; Oberthür, 2009). Notably, global environmental governance literature has highlighted pragmatic solutions and suggested the design, combination and application of knowledge and market instruments as enablers to regulation. For example, Bemelmans-Videc et al., 1998 posited combining knowledge and market instruments for effective governance. In addition, Oberthür (2009) and Chasek et al. (2011) suggested that knowledge management is critical in better environmental governance.

It takes a whole system of governance instruments (knowledge, market and regulation) to shift from flaring to increased recovery and use of associated gas, which this thesis examines. While the negative impact of flaring is a justification to end it, on its own, this rallying cry hardly leads to progress without concrete, pragmatic solutions.

Furthermore, without tackling knowledge and market barriers, exorbitant penalties on their own are unlikely to be a big enough deterrent. This thesis's originality lies partly in systematising the combination of knowledge, market and normative instruments, tracing and assessing their barriers to gauge their effectiveness. It demonstrates originality by mapping, systemising and articulating the global and Nigerian associated gas flare governance, which may make this thesis the first of its kind. The question of who pays is usually a silent one, but I attempt to answer this and offer my views in my conclusions and implications section.

2.3.3   Barriers to efficient associated gas flare governance processes

The literature review on associated gas governance processes contributes to identifying and systemising the barriers to better associated gas flare governance.

Existing literature shows the adoption of models for gas governance but with varying requirements and results. For example, an analysis of Brazil's gas sector transformation found that increasing competition was a critical factor in reducing entry barriers and increased supply and investment in gas infrastructure (Mathias and Szklo, 2007). However, the authors concluded that challenges included an underdeveloped distribution network, lack of gas-specific legislation and guarantees; despite Brazil's adopting a governance model to simplify its processes. Leal et al. (2019) analysed the impact of Brazil's regulation on flare-out projects for replication of its successful transformation. The authors concluded that partnership-based action was instrumental for success.

In turn, Thurber et al. (2011) – drawing extensively from Al Kasim (2006), studied the Norwegian model's applicability for hydrocarbon governance. The model calls for the separation of policy, regulatory and commercial functions. The authors concluded that full-scale separation functions work best in countries with high political competition and capability. However, the required capabilities may not exist in Nigeria, which has chosen to adopt this gas governance model. This thesis uses this idea to represent both the ability to perform specific actions and achieve outcomes.

As far back as 2004, the World Bank's GGFR codified and shared best practices from countries that have successfully ended associated gas flaring (World Bank, 2004), creating best-practice communities. Implementing best practices could reduce institutional inertia at a country level. However, a significant change may be required in national production and consumption behaviours with influential local stakeholders at play.

Notably, Nigeria is transforming its gas sector to adopt the full-scale Norwegian model. This studies barriers and solutions by considering interconnected models such as the Norwegian model to be a prerequisite for better governance. The maturity level of Nigeria's institutions of governance differs from that of Norway, and implementation challenges exist as a two-fold implementation problem. First, there is an ambiguous relationship between the various oil and gas administrative models and the sector's performance. Second, there may be a mismatch between Nigeria's ambition for having separate functions as observed by Thurber et al. (2011). However, the original thinking comes from Farouk Al-Kasim (2006).

While we need collaboration between key players, the chosen transformation model's appropriateness is critical for success. However, we need more recent Nigeria specific insights into the applicability of imported models such as the Norwegian model. Furthermore, we also need to know more about how we can describe enabling environments and gauge their functionality. This thesis

tackles the gaps above by examining Nigeria's application of the Norwegian model and assessing its applicability to unique national situations.

Increased competition is a critical success factor. At the same time, persistent barriers may remain after a transformation, and incremental changes are needed. The term "transformation" implies an entirely different body of literature. However, when used in this thesis, it refers to structural reform for better gas governance. This thesis surfaces the above issues by assessing Nigeria's goal for full-scale adoption of the Norwegian model.

In addition, Nigeria launched its National Gas Policy in 2017, claiming to have adopted best practices. Therefore, it made sense to assess the extent of best practices adoption. To that end, the thesis developed and applied a conceptual framework, which included knowledge management processes and using international climate cooperative initiatives as sources of best practices. Individual power, politics and embeddedness are also important, but first, the gaps in the literature will be explored.

2.4 Development of policy solutions for barriers to associated gas flare governance

The most significant gap in the lack of end-to-end associated gas flare governance literature was the lack of action research. The preceding literature review has shown my positioning of my research as a cross disciplinary work. So, rather than be significantly concerned about lack of literature with a focus on solutions and actions, I saw this as a substantive gap to fill with my thesis. While my thesis is a critique of existing governance arrangement by first systematising it, I offer a lobal and Nigerian view and a way forward.

As outlined in **Figure 2-2**Error! Reference source not found., the literature reviewed revealed gaps and offered a conceptual framework to systematise global and Nigerian associated gas flare governance. For example, while the global environmental governance systematises goals, instruments and processes as the sum of governance to protect the environment, a similar conceptual application to associated gas flare governance is missing. As outlined below, such an action/policy approach could strengthen our knowledge of associated gas flare governance in three ways.

 First, while we know the environmental governance goals, we do not have a similar understanding of associated gas flare governance goals. This thesis tackles the gap by using the environmental governance concept to find actors, systematise, analyse and evaluate their goals (Najam et al., 2006).

While Najam et al. refer to organisations at the global level, international organisations mainly govern by extension through cooperative climate initiatives (Bulkeley et al., 2012; Fenhann et al., 2018).

Second, while we understand how knowledge, market and normative instruments are applied in environmental governance, we do not have similar associated gas flare governance knowledge. There are literature insights on how knowledge, market and norms instruments are designed and applied in environmental governance instruments. However, an understanding of their applicability to associated gas flare governance is needed. This thesis tackles this gap by using the three environmental governance instruments to systematise, analyse and evaluate associated gas flare governance instruments.

Third, we know of at least two practical environmental governance processes as a partnership and independent processes (Oberthür, 2009). However, we do not know the extent of their adoption in associated gas flare governance. For example, we know that Nigeria's NDC is ambitious, and associated gas and flaring plays a critical role. However, we do not know how to coordinate processes to achieve efficient associated gas flare governance goals. Furthermore, it is unclear whether partnership and independent processes appropriately capture ways of achieving efficient associated gas flare governance goals. Therefore, this thesis systematises associated gas flare governance processes.

Figure 2-2 Learning from environmental governance to systematise associated gas flare governance

Source: Author, drawing from multiple academic sources

2.5   Units of study and gaps in literature

2.5.1   Units of study

My units of study also act as places for calls to action. Based on the literature review, no other research had adopted the global and Nigerian units of study in end-to-end research on associated gas flare governance and considered them as units for calls to action. Therefore, it makes sense to develop such research around the units of study for a call to action but linked to the abstraction levels. The two

abstraction levels (global and Nigerian levels) and the objects of my research inform my units of study and call to action.

2.5.1.1 The global unit of study and call to action

I chose the UNFCCC Climate Initiatives Platform as the database to select the most relevant initiatives as units of study (See Bulkeley et al., 2012; Hale and Roger, 2014; Fenhann et al., 2018). The platform was created in 2014 by the Nordic Council of Ministers, and past GHG stocktakes have used the database (UNEP, 2019). It holds 259 initiatives' data, categorised by sectors and themes as shown in **Table 2-2**. There are ten sectors and twenty-two themes. The sectors refer to a broader part of the economy, and themes are groups of climate action.

I used a three-step process and the objects of research to choose my units of study. First, through a logical review, I used "energy" as my inclusion criterion. I eliminated seven sectors and 15 themes from **Table 2-2.** Next, I applied "climate change mitigation" and "GHG emission" and "finance", and "industry" to search the CIP database. This search generated 113 potential units of study. From the 113 likely units, I excluded those without a global mandate (multilevel policy and governance interventions), leaving 73 possible units of study. I then focused on the gas sector as a final inclusion criterion which left six likely units of study.

Table 2-2 Selection of global units of study

Sector #	Sector name	Sector decision	#	Theme name	Theme decision
1	Finance	🟩	1	Private Finance	🟩
			2	Financial institutions	🟩
2	Transport	🟥	3	Transport	🟥
			4	International maritime transport	🟥
3	Agriculture and Forestry	🟥	5	Agriculture	🟥
			6	Forestry	🟥
4	Cities and regions	🟥	7	Cities and subnational governments	🟥
			8	Buildings	🟥
5	Waste	🟥	9	Waste	🟥
6	Industry	🟩	10	Industry	🟩
			11	Innovation	🟩
			12	Business	🟩
7	Non- CO_2	🟥	13	Short Term Pollutants	🟥
			14	Fluorinated gases	🟥
8	Energy	🟩	15	Energy Supply	🟩

			16	Energy efficiency	
			17	Renewable energy	
			18	Energy Access and Efficiency	
			19	Supply chain emission reductions	
9	Adaptation		20	Adaptation	
			21	Resilience	
10	Other		22	Other	

Source: UNEP (2019)

Note: 'Red = sector or theme not included   Green = sector or theme included

From the six likely units of study, I excluded two because they are trade-based initiatives. First, I excluded the International Petroleum Industry Environmental Conservation Association (**IPIECA**). Second, I also excluded the Climate and Clean Air Coalition and Oil and Gas Methane Partnership (**CCAC-OGMP**) and IPIECA and CCAC-OGMP. Third, the Oil and Gas Climate Initiative (**OGCI**) is a more recent and relevant creation. It has committed over $1 billion allegedly committed to tackling climate change. However, OGCI is also a trade-based initiative. Finally, outside the climate initiatives platform, the Gas Exporting Countries Forum was a potential unit of study. However, I excluded it, as it is also a trade-based initiative (GECF, 2019). See **Figure 2-3**.

	GGFR	UNFCCC AM0009	GMI	OGCI	ZRF 2030
Starting year	2002	2004	2010	2014	2015
International lead organisation	World Bank	UNFCCC	U.S.A E.P.A	Top 13 Oil Companies	World Bank
Type of lead organisation	Globla (Financial) Organisation: Public Private Partnership	Multilateral Environmental Agreement	National Government: Network/ Consortium/ Partnership	Private Sector: Network/ Consortium/ Partnership	Global (Financial) Organisation: Public Private Partnership

Figure 2-3 Global associated gas flare governance initiatives

Source: UNEP Climate Initiatives Platform

The five units of study in **Figure 2-3** are the leading global associated gas flare governance climate initiatives (Fenhann et al., 2018). By this, I mean international organisations' efforts, leading to initiatives to transform associated gas flare governance, using a multilevel governance approach to deliver sustainability benefits. These global climate initiatives are new non-state actors who appeared

in the climate action space and set targets for themselves (Bulkeley et al., 2012; Hale and Roger, 2014; Fenhann et al., 2018).

The selected initiatives are relevant as units of study and call to action in three ways. First, Nigerian interventions have used the World Bank MIGA and IFC to supply partial risk guarantees for electricity generation flare-out projects through orchestration (Hale and Roger, 2014; World Bank, 2017). Such interventions are global efforts to secure progress in the reduction of flaring and secure economic growth. Second, the CDM AM0009 is one of the historic carbon market instruments for flare-out projects. Third, the role of gas and oil company membership trade-based initiatives such as the Oil and Gas Climate Initiative (OGCI) is vital in gas flaring climate action.

Based on the above, I collected documents and conducted interviews to answer my research questions.

2.5.1.2 Nigerian units of study and call to action

At the Nigerian national level, I purposefully chose six governmental organisations and three independent initiatives as my units of study and call to action.

- The Ministry of Petroleum Resources (**MPR**) reports to the Nigerian President, who is the substantive Minister of Petroleum Resources.
- I also chose the Department for Petroleum Resources (**DPR**), whose Minister oversees hydrocarbon regulations.
- The 2017 Nigerian National Gas Policy also proposed a Department for Gas Resources (**DGR**) – which exists in concept.
- The Nigerian National Petroleum Corporation (**NNPC**) is essential due to its commercial mandate.
- The Ministry of Environment (**MoE**) is supposed to protect the Nigerian ecological system.
- The increasing recognition of the importance of climate change, especially before and after the Paris Agreement (NDC), led to the creation of the Department for Climate Change (**DCC**) in the MoE.

The DCC could play a prominent climate change mitigation role. Therefore, it would make sense to consider their interaction with the industry regulator in gas governance. While I expect the DCC to play a prominent position on the climate change angle, it does not exclusively own the needed

governance process. However, it is likely to work with other regulators (i.e., DPR) to achieve results. Therefore, it was also essential to analyse gas governance processes between DPR and DCC to meet the NDC targets.

I added the Nigerian Extractive Transparency Initiative (**NEITI**), **NDC Partnership** and **Gas Explorers** to provide a balanced perspective. I used insights from the document analysis to develop interview protocols to conduct semi-structured expert interviews with representatives of the initiatives.

Like the global units of study, I used the organisations mentioned above to guide my document collection and semi-structured expert interviews.

2.5.2   Gaps in literature

The literature review has surfaced three main gaps as outlined in **Table 2-3,** which this thesis addresses. First, gas governance is new compared to that of coal and oil – with the same insight applicable to associated gas flare governance which may mean we do not know enough of what connects SDG to gas governance and climate action. Second, there may also be a poor framing of gas governance as a junior partner to oil, which may not be the case physically, technologically, and economically. Third, better associated gas flare governance could deliver cross-sectoral benefits. Therefore, there may be a need to study gas governance as a new space.

Table 2-3 Summary of gaps in literature and research questions gaps

	We know about	We do not know about	Research aim and questions
Goal coherence	- Global associated flare governance goals coherence is important. - Nigeria's goals for associated gas flare governance - Nigeria's NDC goals	- The goals of global and Nigerian associated gas flare governance and their coherence - Barriers to the global and Nigerian gas governance goal coherence and feasibility - Policy solutions	**Aim:** to systematise global and Nigerian associated gas flare governance as an end-to-end system, surfacing any gaps in minimum viability, with policy solutions. **Research question 1 (*answered in Chapter 4*):** how could the global and Nigerian associated gas flare governance be systematised? **Research question 2: (*answered in Chapter 5*):** what are the manifested barriers, origins for the systematised global and
Effective instruments	- Normative, markets and knowledge-based environmental governance instruments - Best practices and the 2017 Nigerian gas policy	- The types of global and Nigerian associated gas flare governance instruments and their design - Barriers to the effectiveness of the global and Nigerian gas governance instruments	

		- Policy solutions	Nigerian gas flare governance?
Efficient processes	- Four processes of environmental governance with two practically applicable Norwegian model to develop Nigerian gas sector governance processes	- The types of global and Nigerian associated gas flare governance processes - Barriers to the efficiency of the global and Nigerian gas governance processes - Policy solutions	**Research question 3**: (*answered in Chapter 6*): what are the policy solutions for the barriers and origins to the systematised global and Nigerian associated gas flare governance?

Source: *Author*

2.6 Summary of chapter two

There is an arrangement of a global associated gas flare governance arrangements between international organisations, the global initiatives, governments, and gas and oil companies to tackle flaring. Global cooperative initiatives are collaborative partnerships between state and non-state actors (Fenhann et al., 2018). At the Nigerian level, there are governmental and private sector organisation with an interest in governing associated gas flare. However, to gauge viability of such governance efforts, the global and Nigeria's associated gas flare governance needs to be mapped.

The thesis applies the three parts of critical thinking (a) description, including who, what, where and when, (b) analysis, including how and why; and (c) evaluation, including what if, so what, and what next. I linked each theme of goals, instruments and processes to specific research questions to strengthen my argumentation's golden thread.

Therefore, I first systematise the associated gas flare governance as goals, instruments and processes to answer the first research question (**Chapter 4**). Next, I supported the systemisation by identifying and analysing barriers and root origins for coherent goals, effective instruments, and efficient processes (Error! Reference source not found.). Finally, a natural progression is sequenced policy solutions that evaluated "what is there" and "what could be there" to better govern associated gas flaring, answering the third research question (**Chapter 6**). The next chapter outlines the research design and methodology.

Chapter 3 Research design, materials and methods

3.1 Introduction and overview

Chapter 1 introduced the thesis to systematise the global and Nigerian associated gas flare governance. **Chapter 2** reviewed literature to operationalise the research aim and questions and enhance their practical contributions (Sovacool et al., 2018). This chapter strengthens the research questions with specific objectives and a detailed record of the fieldwork to ensure replicability.

The thesis asks socially relevant "big-enough" policy questions (Bellemare, 2017), so this chapter starts with the research design, which lays out the philosophy, approach, strategy and conceptual frameworks in **section 3.2**. S**ections 3.3 and 3.4** are the materials collection and methods, to enable further systematisation work. S**ection 3.5** outlines the limitations of the thesis, clarifies my positionality, while **section 3.6** summarises the chapter.

3.2 Research design

3.2.1 Research philosophy

There are ongoing debates on appropriate philosophies for environmental governance research (Ross, 2017; Sovacool et al., 2018). I take an interdisciplinary philosophical stance. However, I also acknowledge that, as in biodiversity, actors, scales and frameworks could complicate or foster better governance (Paavola et al., 2009). As such, I adopted a pragmatism philosophy. I used retroduction to create exploratory research (epistemology) (Sovacool et al., 2018). I deliberately adopted a pragmatist philosophy to bridge the gap between positivism and interpretivism in systematising associated gas flare governance. However, this is by no means a lifelong bound as my pragmatisms "using whatever works" is my nod to the need for a philosophical stance.

Borrowing insights from qualitative evaluative research, I acknowledged the multiple reality-paradigms (ontology) that could exist in research (Spencer, 1982), especially in new governance spaces. Global initiatives and national governmental organisations created the information used in my systematisation. Nevertheless, individuals whose views are driven by their personal and political interests and embeddedness are the leaders of such initiatives and organisations.

Therefore, I combined both objective and subjective aspects of associated gas flare governance and secured theoretical methodological reflexivity. This process ensured I retained a recognition of the

agency-structure hybrid of the focus and outputs of my study (Montiel, 2007; Feindt and Weiland, 2018). For example, I used objective information to describe increased associated gas use and flaring. However, there are subjectively new elements in my systematisation of associated gas flare governance, which meant using a working hypothesis (Shields and Tajalli 2006).

My target readers are policymakers and academics and I expect their belief systems and attitudes could influence their interaction with my research, so I adopted conceptual frameworks that resonates with their realities (Dellmuth and Bloodgood, 2019). I assessed goal coherence through the conceptual framework of steady communication, intelligent coordination, and a shared sense of direction. Through my framework, I connected manifested barriers to policy solutions as action, a common ground for academics and practitioners. A similar thinking applies to instruments and processes.

3.2.2   Research approach

Informed by the insights from the literature review, I adopted an inductive, multi-stakeholder approach (Fazey et al., 2014). While an inductive approach assumes theory formulation after material collection and analysis, I adjusted my approach, as described in the strategy section. I found and retrofitted conceptual frameworks from environmental governance iteratively, and my retroduction process supported this approach. I applied "gauging" of best practices to assess the system's viability (Shields and Tajalli 2006). I was practical in setting my research questions and objectives. Therefore, I only used materials and methods that were practical to access and analyse.

3.2.3   Research strategy and overview

I used a qualitative evaluation research strategy and adopted a reflective stance to tackle the weakness of a pragmatic philosophy (Lipscomb, 2011). A qualitative evaluation research strategy suited my retroduction of associated gas flare governance (Montiel, 2007; Fankhauser, 2019). My research is not primarily focused on effectiveness (as posited by Hancké, (2013)). Instead, I gauged the coherence of goals, effectiveness of instruments and efficiency of processes as a part of the retroduction to systematise associated gas flare governance (Shields and Tajalli 2006; Rassel et al., 2021, pp. 28-57).

Besides, the strategy suited my social construction of the meaning of associated gas flare governance. It enabled an in-depth exploration and access to perspectives of the social actors (Sovacool et al., 2018, p. 18). I could have considered the units of study at both abstraction levels as case studies.

However, while the global initiatives (as interventions) met the case study test of representative occurrences and commonalities, this was not true for the Nigerian organisations (Gerring, 2004; Flyvbjerg, 2006). Notably, I scoured peer-reviewed articles and documents to answer my first research question. While this looked like a narrative literature review, I leaned into the qualitative evaluative strategy.

I made explicit justifications for my practical choices to show reflexivity but also guide any subsequent researchers who chose to use my methods. Second, I considered principles of intelligent research (Hancké, 2013, pp. 85-106) but relied on making common-sense choices to avoid over-sophisticating or complicating the application of my strategy and methods.

An overview of the detailed materials and methods **sections 3.3** and **3.4** is summarised in **Table 3-1**.

Table 3-1 Research overview

Aim: to systematise global and Nigerian associated gas flare governance as an end-to-end system, surfacing any gaps in minimum viability, with policy solutions.	

Research question one (Chapter 4): how could the global and Nigerian associated gas flare governance be systematised?
 	
  ✓ **Research objective one:** to develop a conceptual framework for systematising global and Nigerian associated gas flare governance.
  ✓ **Research objective two:** to systematise (a) global and (b) Nigerian associated gas flare **governance.**
  ✓ **Research objective three:** (a) to chart the emerging barriers to the systematised global and Nigerian associated gas flare governance and (b) assess the viability (after charting the barriers to a systematised global and Nigerian associated gas flare governance).
	Strategy: Qualitative evaluation research.
	
	Materials: 76 documents sources (40 global/36 Nigerian).
	
	Methods: A content, thematic, narrative and discourse analysis.

Research question two (Chapter 5): what are the manifested barriers, origins for the systematised global and Nigerian gas flare governance?
 	
  ✓ **Research objective four:** to trace manifested barriers and origins for the systematised (a) global and (b) Nigerian associated gas flare governance.
  ✓ **Research objective five:** to determine significant barriers and their root origins for the (a) global and (b) Nigerian gas flare governance.
  ✓ **Research objective six:** to assess the viability of the global and Nigerian; associated gas flare governance systems based on the manifested barriers and origins.
	Strategy: Qualitative evaluation research.
	
	Materials: Semi-structured elite interviews (flare reduction and gas governance power, influence and or expertise) (11 global and 19 Nigerian).

Research question three (Chapter 6): what are the policy solutions for the barriers and origins to the systematised global and Nigerian associated gas flare governance?
 	
  ✓ **Research objective seven:** to devise solutions to the manifested barriers and origins for the systematised (a) global and (b) Nigerian associated gas flare governance.
  ✓ **Research objective eight:** to determine the sequencing and prioritisation of the policy solutions for the systematised (a) global and (b) Nigerian associated gas flare governance.
  ✓ **Research objective nine:** to assess the viability of the systematised (a) global and (b) Nigerian associated gas flare governance after application of policy solutions.
	Methods: Thematic, narrative and discourse analysis.

Source: Author

3.3 Materials and methods

This section showcases how I executed my research design. It ensures transparency of my triangulation process and replicability of my research (Bowen, 2009, p. 27; Sovacool et al., 2018).

3.3.1 Document collection for systemising associated gas flare governance

This section (and **sections 3.3.2 to** Error! Reference source not found.) covers document materials and methods to answer my first research question "how could the goals, instruments and processes of associated gas flare governance be systematised?".

Using generic and specific search criteria, I conducted online searches and collected 76 documents. My generic criteria were governance goals, instruments and processes. My specific criteria were flare reduction and associated gas flare governance goals, knowledge, market and normative instruments and processes. The documents were from diverse sources, as shown **Table 3-2**.

I did not apply sampling due to the small number of available documents (Sovacool et al., 2018, p. 24). Instead, I only selected those documents with information on both the generic and specific search criteria. Furthermore, I chose documents if they led to added insights into my research, for example, widening the view and considering the perspectives of multiple stakeholders.

Table 3-2 Summary of document catalogue

Type of document sources	# Global level	# Nigerian level
Database	4	2
Journal article	3	3
Policy	0	4
Policy guidance, strategy and briefs	2	9
Report and donor positioning statement	9	8
Website	14	12
Act/regulation	0	3
Newspaper article	0	3
Total	**32**	**44**

Source: Author

Websites were helpful, especially at the Nigerian level. Also useful were annual reports, GHG data, climate change laws, policies and plans and reports and guidance. I used triangulation to contend with some flaws of document sources (Yin, 2012, p. 80).

Furthermore, in agreement with Bowen (2009, p. 28), I collected and used academic articles which proved to be helpful for both conceptual frameworks and insights for a deeper understanding of associated gas flare governance. Therefore, academic articles also served as evidence instead of only informing my research gap. Besides, I analysed the documents for exploratory, descriptive and gauging purposes. Finally, I used these insights to intelligently design an interview question to answer my second and third research questions.

3.3.2   Documents analysis to systematise associated gas flare governance

Sovacool et al. (2018, pp. 29-30) detailed three qualitative analytical methods for evaluative qualitative research: content, narrative/thematic, and grounded theory analysis. I used content analysis and coded my documents according to the authors' guidance. However, I complemented it with thematic/narrative analysis. Besides, where content analysis did not work, thematic/narrative analysis enabled better storytelling. I did not see the need to use grounded theory as both the content and thematic/narrative sufficed for the systematisation-barriers-solutions focus on my research.

Najam et al. (2006) defined goal coherence as (a) intelligent coordination, (b) steady communication and (c) a sense of shared direction, which I applied as sub-categories for my analysis. So, for example, while content analysis helped describe the associated gas flare governance goals, I also needed thematic and narrative analysis to systematise them.

By complementing content with thematic analysis, I showed objectivity (fair review of the materials) and sensitivity (responding to their deeper meanings) (Tracy, 2010) to frame and tell the story of associated gas flare governance. Therefore, I was able to gain a deep understanding of the social construction of the components of an associated gas flare governance system (Bowen, 2009; Alrazi et al., 2015; Kuckartz, 2019).

In what follows, I detail the analytical procedures to systematise (1) goals, (2) instruments and (3) processes. I maintained qualitative academic rigour by using the Chicago Manual of Style (17th edition) to reference each piece of evidence using footnotes. On reflection, my systemisation worked well based on the quality of interview questions generated from the document analysis judged by the

insights the interviews provided (Urquhart et al., 2009). Hopefully, this procedure enables replicability of my results, but at the very least, it provides transparency.

3.3.2.1 Documents analysis to systematise associated gas flare governance goals

In line with Najam et al., 2006, associated gas flare governance goals, whatever they are - could be systematised as coherent or incoherent and be comprised of (i) steady communication (between co-owners of a problem), (ii) intelligent coordination and (iii) a shared sense of direction. These were the conceptual frameworks I used to systematise global and Nigerian associated gas flare governance goals.

Global level systemisation of associated gas flare governance goals

Table 3-3 is a modification from a report for the Nordic Council of Ministers on the effectiveness of global climate initiatives (Fenhann et al., 2018). I used it to systematise the goals of the five global climate initiatives who are interested in associated gas flare governance.

Table 3-3 Systemising global gas governance goals

Name.	Name of the initiative.
Start year	The year the initiative was set up.
Lead organisation	Name and type of lead organisation(s).
Goals	The initiative's goal. Is it specified (qualitative) or quantified (quantitative)?
Progress	What is the progress against the goal?

Source: Fenhann et al. (2018) *

* Note: *This is an adaptation of original work for the Nordic Council of Ministers. The responsibility for the views expressed in the adaptation rests solely with me.*

Nigerian level systemisation of associated gas flare governance goals

Since 1960, Nigeria has gone through multiple gas-sector transformations phases (Adeniji, 2012). Therefore, I used a detailed timeline and a thematic analysis to set a historical context and then conduct the content analysis.

Nigeria wants to secure associated gas commercialisation and a substantial part of its NDC target by ending flaring. Given its decarbonisation potential, it is also not surprising that ending flaring/increased gas recovery is factored in Nigeria's NDC (UNFCCC, 2015; Elvidge et al., 2018). Therefore, ending flaring is commercially vital for Nigeria. However, it is an opportunity to secure economic growth, tackle energy security challenges and climate change.

3.3.2.2 Documents analysis to systematise associated gas flare governance instruments

The literature highlighted knowledge, market and normative instruments as three environmental governance instruments (Bemelmans-Videc et al., 1998; Paavola, 2007; Oberthür, 2009; Chasek et al., 2011). I used these conceptual frameworks to systematise global and Nigerian associated gas flare governance instruments.

Global level systemisation of associated gas flare governance instruments

In this thesis, simple or complex mechanisms are the types of knowledge instruments used to reduce the cognitive cost of flare reduction and increased gas use. Market instruments use economic arguments to influence behaviour and rely on the interaction of supply and demand. For clarity, I consider normative-based governance to include norms, standards and rules used to change behaviours. The normative mechanisms are hierarchy command and control, hard targets and standard setting.

Based on the above concepts, as shown in **Figure 3-1**, I developed a three-phase coding plan for the global level, using multiple sources to triangulate my results (Bowen, 2009, p. 27; Kuckartz, 2019). This systematisation was also applied to the Nigerian abstraction level but with a greater challenge in finding document evidence.

In phase one, I used the knowledge, market and normative (Bemelmans-Videc et al., 1998; Paavola, 2007; Oberthür, 2009; Chasek et al., 2011), for my broad-stroke coding (Bowen, 2009). In phase two, I coded the mechanisms of the three gas governance instruments and generated analytical memos. Finally, in phase three, I summarised the analytical memos into headline results. The above process meant I secured corroboration and rival explanatory evidence to frame the global associated gas flare governance story.
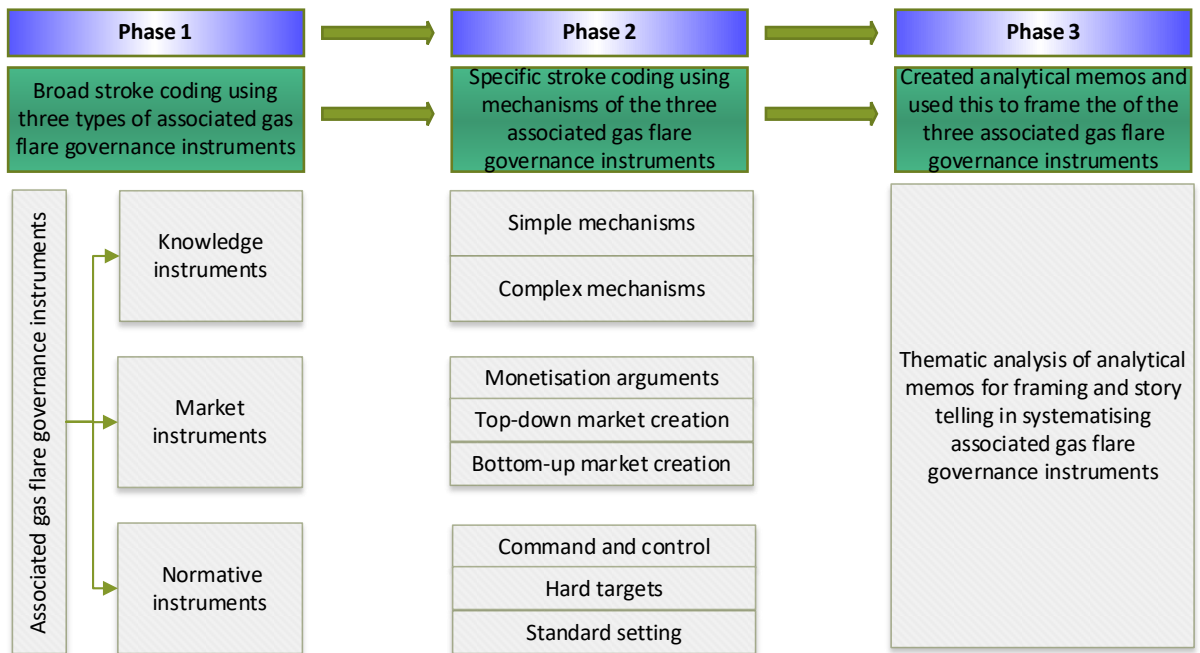
Figure 3-1 Systemising global and Nigerian associated gas flare governance instruments

Source: Author

See **Table 3-4** for the analytical memos framing the three instruments.

Table 3-4 Systematising associated gas governance instruments

Knowledge	• Knowledge enabling mechanisms reduce barriers to achieving the desired change.
	• It could also mean altering the cognitive priority of specific options (Stokke, 2001; Oberthür, 2009; Chasek et al., 2011).
	  ○ Simple learning mechanisms denote the exchange of information.
	  ○ Complex learning mechanism goes beyond the exchange of information, building capabilities through best practices to develop knowledge.

Market	• Rewarding behaviour through economic means or allocation and stimulating the market (Bemelmans-Videc et al., 1998; Oberthür, 2009). • A market arrangement or financing mechanisms deployed to alter the utility value. • Incentives for adhering to rules in increased extraction and utilisation of gas.
Normative	• Normative or regulatory governance involve prescription instruments (Bemelmans-Videc et al., 1998; Paavola, 2007; Oberthür, 2009). • Use of normative values, advocating for change in laws including regulation and targets. • Prescription of behaviours in projects to capture and use gas to qualify for carbon credits. • Actions meant to alter the beliefs of "what is acceptable." (Paavola, 2007)

Source: *Modified from multiple academic authors cited in the table.*

Nigerian level systemisation of associated gas flare governance instruments

The Nigerian level had lower quality of documents; therefore, I applied the global level analytical methods with modifications and two notable departures. First, as I did with the goals, I went straight to thematic analysis. Second, the global level analysis had yielded the best practices expectation of instruments of associated gas flare governance which guided my Nigerian level thematic analysis. However, I also used a timeline analysis to set the historical context of Nigeria's institutionalisation of associated gas flare governance instruments.

As far back as 2004, the World Bank's Global Gas Flaring Reduction Partnership (**GGFR**) codified the experience of countries that had successfully tackled flaring (World Bank, 2004; 2005; 2009). Based on the decades of lessons learned, I deemed this guidance as best practice in what constitutes effective instruments for systematisation (including goals and processes). Therefore, I used them for my gauging analysis. Furthermore, Nigeria claimed to have adopted international best practices in its 2017 National Gas Policy. Therefore, my analysis also focused on the manifestation of the best practices in the 2017 gas policy.

3.3.2.3 Documents analysis to systematise associated gas flare governance processes

Processes were already covered in environmental governance literature as interplay (Oberthür, 2009), but my gauging analysis may have led to new insights in systematising global and Nigerian associated gas flare governance processes (see section **3.3.3**).

Global level systemisation of associated gas flare governance processes

The two processes below were taken from the environmental governance literature review: independent and partnership structures (Oberthür, 2009). Independent processes require a lower level of coordination with other horizontal (peer) actors but more coordination with a vertical (top-down) actor. On the other hand, a partnership is a loosely coupled relationship. I used these two processes to code and thematically analyse the collected documents. See **Table 3-5**.

Table 3-5 Systematising associated gas flare governance processes

Independent	• Lower level of coordination with other horizontal (peer) actors but coordination with vertical (top-down) actors. • It involves working within the existing rules of a single process – for example, CDM. • Involves cooperation between members within existing boundaries of the lead actor organisation without joint decision making. **Mechanisms:** Hierarchical, tiered command and control system and A lower degree of horizontal coordination

Partnership	• Loosely coupled relationships between similar organisations drawing on the goodwill of members and only soft targets. • They may, like joint governance, coordinate plans and processes – but the critical difference is that a partnership is a loosely coupled relationship. **Mechanisms:** Sharing of resources – joint governance to coordinate plans and processes and specific efforts to coordinate plans and processes

Source: *Modified from* Oberthür (2009)

Nigerian level systemisation of associated gas flare governance processes

The systemisation of Nigeria's associated gas flare governance processes was not as straightforward as the global level due to fewer delineated processes. Two main themes emerged as Nigeria's adoption processes - the Norwegian model (Al-Kasim, 2006; Thurber et al., 2011) and the best practice expectation of countries with gas reserves for collaborative processes between environmental and industry regulators (World Bank, 2004; 2009).

I applied the Norwegian model framework to assess Nigeria's separation of gas governance functions as processes (Al-Kasim, 2006; Thurber et al., 2011). I also used the GGFR's best practice expectations to analyse gas and environmental regulatory activities (World Bank, 2004; 2005; 2009).

Coordination is needed between co-regulators to reduce regulatory complexities, and roles must be clear. Besides, the regulator should be independent of political interference with a clear scope of activities. There is an agreement of sorts for this best practice between GGFR and the Natural Resource Institute (Natural Resource Institute, 2012).

3.3.3   Documents analysis for systematising emerging barriers for associated gas flare governance

At this point, I switched to thematic and narrative analysis to surface the emerging barriers. I reviewed each of my analytical memos to gauge coherent goals, effective instruments and efficient processes. I re-read my results carefully to describe the nature of the emerging barriers.

I articulated the "as-is" governance system by applying a concept, thematic and narrative analysis and highlighted eleven emerging barriers to a systematised global and Nigerian gas governance. I used a matrix to categorise and report my results. Each of the emerging barriers happens at the global or Nigerian level or both. I also tagged the emerging barriers as either for goals, instruments and/or processes.

Another result of my systemisation process included finding aspects barriers of governance that environmental researchers did not previously cover. For example, I used Al-Kasim (2006), combined with Thurber et al. (2011) and the World Bank Worldwide Governance Indicators (World Bank, 2020), to assess Nigeria's adoption of the Norwegian model to govern gas. I also captured best practices from the global gas governance initiatives that were not originally part of my investigation.

3.3.3.1   Emerging barriers for goal coherence

From the literature, I established that although the global climate initiatives are relatively new actors, it is essential for the integrity of the UNFCCC process to assess their goals (Fenhann et al., 2018). Therefore, I in highlighting emerging barriers, I considered whether goals were specific and checked for intelligent coordination, steady communication and a shared sense of direction (Najam et al., 2006; Biddle and Koontz, 2014).

For example, my analysis started with unpacking the goals and rationale at the global level, determined by the realities of achieving the most with limited resources. The goals of global initiatives are stipulated by sponsors, creating bounded options or strategic fields (Fligstein and McAdam, 2015). Each of the initiatives has a goal that broadly targets associated gas flaring. However, a closer examination of the specificity of their goals and coherence led to emerging barriers.

For the Nigerian level, the analysis showed three goals (a) gas commercialisation and (b) gas-linked-NDC and both are linked to (c) gas-based industrialisation. There were multiple governmental agencies involved in realising these goals. However, a closer thematic and narrative analysis led to emerging barriers.

3.3.3.2 Emerging barriers for effectiveness of instruments

Associated gas flare governance instruments need to be effective, and effective knowledge and market mechanisms are enablers of normative instruments. Therefore, designing and deploying all three instruments is a prerequisite for the effectiveness of governance instruments (Oberthür, 2009).

Content analysis meant I read and re-read the results from the systemisation and consulted the documents to understand how each of the global level units of analysis designed and used governance instruments. The analysis of the global units of the study showed a standalone nature in their design and a reluctance to develop norms or standards.

Nigeria claimed to have adopted international best practices in designing its 2017 National Gas Policy. However, it was not easy to find published information to assess this claim and understand how instruments are designed and applied to govern gas in Nigeria. Therefore, it also made sense to make this the centrepiece of analysing its gas governance instruments.

The essence of any policymaking is to generate impact. Therefore, I used the fundamentals of the policymaking framework to assess the chances of Nigeria's gas policy achieving impact (CPI, 2017). The framework has three dimensions with nine data points used to assess the 2017 Nigeria national gas policy.

The three **dimensions** and *nine data points* are (1) **policy design**, (a) *clarity of objectives*, (b) *evidence base* and (c) *feasibility of the policy*, (2) **legitimacy**, (a) *investor confidence*, (b) *stakeholder engagement* and (c) *political commitment* and (3) **real-life action**, (a) *management*, (b) *measurement* and (c) *alignment of objectives and outcomes*.

3.3.3.3 Emerging barriers for efficient processes

The literature review highlighted two environmental processes (Oberthür, 2009) that I used in my systemisation of associated gas flare governance. However, they did not work in the analysis of emerging barriers to efficient processes due to the richer context (Sovacool et al., 2018, p. 30). Therefore, I logically created three descriptive categories as described in my conceptual frameworks (**section** Error! Reference source not found.).

I developed three concepts for systemising gas governance processes which I also applied to the global and Nigerian level analysis:

1. Not knowing whom to collaborate with.
2. Lack of capability.
3. Lack of willingness or an enabling environment to collaborate.

These processes are examined further in my discussion chapter before proposing new aspects for systematising the global and Nigerian associated gas governance processes.

First, associated gas flare governance processes could be collaborative (ideally), which means knowing relevant actors for collaboration. Second, an enabling environment and willingness to collaborate could be helpful. Third, the capability to collaborate is also an essential requirement for efficient processes. Capability includes the technical know-how to solve gas flaring as a sustainability problem factoring in climate action. On this basis, I analysed the results to highlight the emerging barriers. I call out specific modifications below.

3.3.3.3.1 Modifications for analysing associated gas flare governance processes

Knowledge management in global associated gas flare governance processes: I found a potential focus on knowledge management in associated gas flare governance. As such, I investigated its application, improving the quality of my results.

As outlined in **Table 3-6**, the four knowledge management processes were critical to gauging how knowledge-based governance is developed and applied in associated gas flare governance. However, the table below was more helpful in analysing the global level than the Nigerian level.

This difficulty was because the Nigerian level was more complex, focusing on coordination between critical governmental actors like the environmental and industry regulators. Notably, this was one of the emerging barriers which became significant as the study progressed.

Table 3-6 Systematising knowledge management process

1. Creating knowledge 2. Acquiring knowledge 3. Storing knowledge 4. Sharing knowledge	Documents, databases, routines and processes	GGFR	AM0009	GMI	OGCI	ZRF 2030
		Data capture and entry based on coding for the initiatives				
	Within initiative					
	Cross initiative					

Source: *Author based on* Chasek et al. (2011).

Lack of capability and systems thinking: the Norwegian model adopted by Nigeria advises separating policy, regulatory and commercial functions as processes. However, there are potentially four versions, represented in the two-by-two frame in **Table 3-7**.

Table 3-7 Framework for analysing Nigeria's adoption of the Norwegian model

		Political Dynamics	
		Low Political Dynamism	*High Political Dynamism*
Governance capability	**High Capability**	**Quadrant III** **Suggest:** -Consolidating functions initially -Consider separating functions upon signs that politics become more pluralistic. **Examples:** *Malaysia.*	**Quadrant IV** **Suggest:** -Separate functions. **Examples:** *Norway, Brazil, and Mexico*
	Low Capability	**Quadrant I** **Suggest:** -Combining functions. **Examples:** *Angola*	**Quadrant II** **Suggest:** -Developing policy, regulatory and commercial capability, and capacity before continuing to Quadrant III and then IV. **Examples:** *Nigeria.*

Source: Al Kasim (2006); Thurber et al. (2011)*.*

The full-scale separation of functions, **Quadrant IV**, was invented by Norway and adopted by Brazil and Mexico. Authors like Al-Kasim and later Thurber et al. have advocated for a reflection of reality by developing countries. This caution could be based on an understanding of their political dynamism and capability, which could be high or low, before deciding which quadrant to adopt. The level of political competition determines political dynamism through political competition, how power constantly changes hands, and through elections every five years.

In addition to the above, the World Bank Worldwide Governance Indicator uses six indicators: (1) control of corruption, (2) government effectiveness, (3) the voice of accountability, (4) political stability and absence of violence and terrorism, (4) regulatory quality, (5) the rule of law and (6) voice and accountability, to assess the maturity of national institutions of governance (World Bank, 2020).

I used both the Norwegian model framework and World Bank's indicators to assess Nigeria's capability versus that of Norway to figure out the appropriateness of the Norwegian model.

Furthermore, I captured and analysed Nigeria's DCC request for support which showed a keen awareness of building capability (NDC Partnership, 2021). This analysis led to emerging barriers in how the request was structured and showed signs of a lack of collaboration between global and Nigerian actors or systems thinking, as formulated in my results. The above led to my insights on emerging barriers for efficient processes.

Next, I describe my interview processes and analysis to further problematise associated gas flare governance barriers and devise targeted policy solutions. This next section describes the materials collection and analytical methods for the "to-be" associated gas flare governance system.

3.4 Materials and methods: Elite interviews to trace barriers and devise solutions

This section (**3.4.1** to **3.4.7**) covers interview materials and methods to answer my second and third research questions, with the results presented as the manifestation of barriers (Error! Reference source not found.) and solutions (**Chapter 6**).

I conducted the interviews with the approval of the University of Leeds Ethics Committee (**Appendix A**). My research had limited ethical issues, as it is neither personal nor sensitive. However, in line with at least three best practices and my ethical approval guidance, I sought informed consent in writing (before the interview date) and verbally (on the interview date) (Coffey, 2015; Lie and Witteveen, 2015; Roth, 2018; Roth and Unger, 2018).

3.4.1   Recruiting elite interviewees

As an extension of the pragmatic aspect of my research philosophy, I reasoned that it was sensible to target and recruit elite interviewees (Woods, 1998). Sovacool et al. (2018, p. 20) referred to the act of

accessing elites as a means of demonstrating originality in research. In agreement with Sovacool et al., I defined elite interviewees as the staff of the units of study if they had ten years of experience or more and were decision-makers. These elites comprised experts, influencers and decision-makers who could practically answer my call to action – to end flaring through increased associated gas use and better governance. Therefore, I actively recruited my elite interviewees from the units of study, with the practical intent to further engage them in generating impact for my postdoctoral work.

I used my research brief, letters of introduction from the University of Leeds and my employer (the UK Cabinet Office, then the Department for Business, Energy and Industrial Strategy) and reached out to my potential interviewees by email. I followed up with phone calls and reminder emails with varying success. For example, at the global level, I was passed around from the capabilities team at the UNFCCC to the partnerships team until I reached the regulatory team, where I interviewed three staff members. Unfortunately, I could not recruit any staff member from the Nigerian National Petroleum Corporation (NNPC) despite several attempts.

Ten-years practical experience was my target for recruiting interviewees. While there might be many other qualified staff members from my units of study with more than ten years of experience, I applied purposive sampling, which was not random to find participants for my research. I prioritised access and depth of experience in recruiting the interviewees (Maxwell, 2013, pp. 96-100).

I recruited 11 interviewees from six global level. In addition, I recruited 19 interviewees from Nigerian governmental organisations covering government, capability building, Transparency Initiative, and NGOs. See **Table 3-8** for the profiles of my elite interviewees at both abstraction levels. See **Appendix B.1** and **Appendix B.2** for the codes and years of experience.

Table 3-8 Profile of interviewees

Global interviewees		
Perspectives	**Role**	**N**
Five global case study initiatives	Senior-level strategists	2
	Programme manager	1
	Communication officer	1
	Sustainability managers	4
	Investment manager	1
Independent actors	Carbon Disclosure Standards Board	1
	CEO of gas commercialisation entity	1
	Total	**11**
Nigeria interviewees		
Perspectives	**Role**	**N**

Nigerian government - MPR	Special Advisors	2
Nigerian government - DPR	Senior Officials	3
Nigerian government – MoE/DCC	Senior Official	1
Transparency initiative	Director and Senior Managers	4
Global capacity building	Senior Technical Gas Consultant	1
Private equity gas investor	CEO	1
NDC Enhancement	Senior Managers	2
NGO	Senior Managers	3
Gas commercialisation company	CEOs	2
Total		**19**

Source: *Author*

3.4.2   Ethics: Informed consent and confidentiality

I faced and overcame two issues in accessing the elite interviewees and recruiting them by being pragmatic.

First, by their definition, elite interviewees are not easy to access. Therefore, I moved horizontally along my social and professional networks to find and recruit interviewees at the global level (Geddes et al., 2017). I was previously a Senior Policy Advisor at the UK Cabinet Office but now lead on the UK's Home Decarbonisation Policy at the Department of Business, Energy and Industrial Strategy (BEIS). With the support of my employers, I secured introductions to senior officials at the UNFCCC CDM AM0009. I also used the network of a senior career sponsor at the World Bank to secure an introduction to the Global Gas Flaring Reduction Partnership (GGFR) and Zero Routine Flaring (ZRF). At that point, I applied snowballing to be introduced to other interviewees at the global and Nigerian levels.

Second, after completing my global level interviews, due to COVID-19, I could not travel to Nigeria to conduct face-to-face interviews. Given Nigeria's high context culture, this was a major challenge. As a counterfactual to Geddes et al., I used my global contacts to drill vertically (they suggested focusing horizontally). I switched to Microsoft Teams for my interviews and secured online interviews, which became more effective than the face-to-face interviews.

I recorded the interviews with the interviewees' consent, and I only commenced interviews after securing informed consent. My "Microsoft Teams" recorded videos proved helpful in contextualising my transcriptions.

3.4.3   Triangulation and diversification of results through elite Interviews

As described in **section 3.3** (with results presented in **Chapter 4**), my systemisation of associated gas flare governance through documentary analysis had shown 11 emerging barriers arising from incoherent goals, ineffective instruments and inefficient processes at both abstraction levels. However, these were not substantive or explanatory. Therefore, I looked for triangulation (Bowen, 2009; Kuckartz, 2019) through two interviews at both abstraction levels. Through this process, I secured corroboratory and explanatory evidence, which confirmed the emerging barriers. Most importantly, I secured solutions from the experts. See **Appendix B.3** and **Appendix B.4** for the global and Nigerian interview protocols.

3.4.4   Transcription of interviews and retaining anonymity

I transcribed the interviews using NVivo transcription to speed up the process, using intelligent transcription. Then, I went back to my Microsoft Teams video calls - the audio/video files to listen again to refine my insights. Next, I anonymised my interviewees and their insights and assigned codes, for example, GINT1-GINT11 and NGN1-NGN19, to represent global and Nigerian level interviewees. Finally, to prove the elite status of my interviewees, I explained the codes and identities to my supervisory team and provided enough insights to retain anonymity in **Table 3-8** and **Appendix B**.

There were two instances when I could have waived the anonymity of interviewees. A global interviewee insisted I attributed their views on the fitness-for-purpose about one of the global units of analysis. A Nigerian interviewee also insisted on waiving anonymity to "send a message" to the COP26 Presidency (at the UK Cabinet Office) on the need for financing NDCs and resolving the financing gap. On both instances, I decided to retain the anonymity of these interviewees to protect them and the other interviewees.

3.4.5   Analysing interview transcripts

I used my interviews to generate evidence of whether my emerging barriers were authentic or a product of a poorly conducted document analysis or something else. I mitigated the risk of the inappropriateness of interviews as a way of revealing further insights by conducting and cross-referencing an extensive document analysis using footnotes**.**

In addition, I cross-referenced my transcripts for triangulated insights (Dean and Whyte, 1958). As such, I engaged with my elite interviewees about framing the story of associated gas flare governance, leading the way but switching roles from storyteller to record keeper to generate useful insights. Through this process, I generated corroboratory and alternative evidence and targeted policy solutions using a narrative and discourse analysis.

As a reminder for my readers, the story told records kept from the interviews are in two parts and linked to the results from the systematisation of associated gas flare governance and emerging barriers. First, there is the story of how the barriers manifest to constrain associated gas flare governance at both abstraction levels with the results presented in Error! Reference source not found.. Then, there is the story of how there are targeted, prioritiseabke policy solutions to tackle the manifested barriers at their root origins with the results presented in **Chapter 6**.

3.4.6   Tracing barriers to associated gas flare governance systematisation

In addition to the preceding **sections 3.4.1** to **3.4.5,** this section outlines the basics of how I answered my second research question "to what extent do barriers constrain and undermine global and Nigerian associated gas flare and climate governance, both individually and as a connected entity?"

I used the emerging barriers from **Chapter 4** to develop global and Nigerian level interview protocols. An overarching definition for the ensuing gauging analysis is that a governance system is viable if it has coherent goals, effective instruments and efficient processes. I traced the origins of the manifested barriers and the subsidiary aspects of the research. I also traced the origins of the barriers and generated useful insights by codifying significant and root origins barriers to highlight their criticality.

I adapted a network path analysis of tracing the barriers to their root origins and influences, advancing how we consider barriers for gas governance (Lee et al. n.d) and gauging goal coherence, the effectiveness of instruments and efficiency of processes. Each of my three conceptual frameworks (goals, instruments, and processes) is a category within which I first linked the 11 emerging barriers from the systemisation process to the manifested barriers.

In agreement with Lee et al., a barrier is a factor that prevents a governance system from reaching a minimum, viable state, and it affects other barriers and influences. In line with Lee et al., a barrier is significant if it connects to four or more barriers or influences. Likewise, an origin is a root origin

related to four or more origins and/or barriers. An origin is where a barrier starts. An influence is an outcome of a barrier.

An influence is affected by a barrier. There are nine influences: three for each of the three aspects of my research (goals, instruments, and processes).

- **Influences of incoherent goals**: For example, goal coherence is about intelligent coordination, steady communication and a sense of shared direction to solve collective environmental governance problems (Najam et al., 2006).
- **Influences of ineffective instruments**: An effective governance instrument is about effective knowledge, market and normative instruments (Bemelmans-Videc et al., 1998; Paavola, 2007; Oberthür, 2009; Chasek et al., 2011; Bulkeley et al., 2012).
- **Influences of inefficient processes**: Processes are covered in environmental governance literature as interplay (Oberthür, 2009), but my gauging analysis may have led to new insights. I developed three concepts for systemising gas governance processes. I suggested (a) not knowing whom to collaborate with, (2) lack of capability and (3) lack of willingness or an enabling environment to collaborate, which I also applied to the global analysis. These processes are examined further in my discussion chapter before proposing new aspects for mapping gas governance (see **section 7.4**). See Error! Reference source not found. for the results of the manifested barriers.

3.4.7   Devising solutions for associated gas flare governance systematisation

This section outlines the basics of how I answered my third research question "what the policy solutions for the manifested barriers of better associated gas flare governance system at the global and Nigerian level might be?" This is in addition to the methods of analysis outlined in **sections 3.4.1 to 3.4.6**.

I also used an elite interviewee approach to devise targeted policy solutions. I evaluated the solutions and the system for minimum viability with an analytical and evaluative lens. Methodological insights from the earlier literature helped devise and sequence the policy solutions. The third question was essential as policy solutions are needed to shift the system towards viability.

In prioritising the solutions, I was aware that root origins and significant barriers could stifle their implementation. Therefore, I planned a focus group to test and evaluate the match between my

solutions and the barriers. However, the restrictions of conducting fieldwork during Covid-19 meant I had to practically reason out the solutions without further insights from my elite interviewees. See **Chapter 6** for the results of the policy solutions for both abstraction levels.

3.5   Limitations, positionality and saturation

3.5.1   Limitations

I acknowledge the limitations of my thesis with humility but gratitude for the opportunity to have learned a lot about the messy yet rewarding doctoral research process. Nevertheless, my readers should bear in mind the following three limitations.

The first limitation relates to my exploratory study of global associated gas flare governance as a new concept. This exploratory nature posed questions about qualitative rigour and validity when coupled with my early researcher status. I mitigated this limitation with candour, acknowledging weaknesses when I am aware of them. However, I also explicitly reflected on qualitative rigour in my conclusion. I am pragmatic and understand that realities are multiple, and "what works" matters for effective policymaking and governance. My pragmatism reflects how I see and describe problems - as yet-to-be-implemented solutions.

My second limitation is that due to Covid-19 travel restrictions, I ran out of time to conduct a focus group to challenge my findings. The policy solutions would have been better if I had the opportunity to go back to the actors and tested it with them to enhance the chances of their implementation. However, I went back to two of my independent global level interviewees. One said, "The results are interesting and point to the realities that the global order can better influence national-level actions through working together (GINT1-1st global level interviewee). The second interviewee said, "They were happy to engage further with the key global and national interviewees to raise the needed financing" (GINT2-2nd global interviewee).

My third limitation is that while I considered individuals' politics and their embeddedness, it was not easy to assess them objectively. I found over 84 instances of individual politics in the thesis. Where possible, I recognise such vested interest and what it may mean for my findings. However, it may be that the politics of individuals and their embeddedness led to the manifestation of the barriers, which may also contribute to a lack of implementation of the solutions. In addition, the barriers at the Nigerian level could also stem from the politics of individuals and their embeddedness.

3.5.2   Positionality and saturation

Preconceptions need to be set aside as realistically as possible when conducting social science research (Roth and Unger, 2018). I was keenly aware of my pragmatic philosophies. However, I leaned into them to add value to my thesis and develop practical solutions. For example, in the last six years, I have worked at the UK Cabinet Office and then the Department for Business, Energy and Industrial Strategy. As a Senior Policy Advisor and then the Head of Fiscal Policy Strategy, I solve interconnected policy problems with complex barriers. Solving these national policy problems means corralling government agencies and departments for a collective solution. The solutions are often contested and challenged due to vested interest and require pragmatic and political choices to be implementable. I found the most adopted solutions were the ones usually in the middle ground of pragmatism.

As a social science researcher, I am the primary research instrument. By relying on my skills and intuition, I filter and interpret the results. Therefore, I considered and managed my theoretical sensitivity and understanding of meaningful and meaningless data (Tracy, 2010). While I could have started the research with no preconceptions (ideally), this was impossible. Instead of shying away from this, I leaned into it to enrich my thesis.

I catered for my theoretical sensitivity through practical means. I systematically read my raw results line by line for each level, linking key concepts to other sources through codes and re-categorising dimensions of the results. Furthermore, I extended my fieldwork, checked interviews or documents for insights to evaluate my results against the reasons behind the results. Future researchers could replicate my study using the process.

I reached saturation when the data analysis painted what I assumed to be a consistent picture of the phenomenon of global gas governance at both abstraction levels. My consideration of saturation is also about being practical, coming to the end of my research time for the PhD. I intend to continue engaging with this subject for a more extended period as a postdoctoral researcher.

3.6   Summary of chapter three

This chapter has outlined the materials collection and methods of analysis for systematising associated gas flare governance showing a constant, long-term relationship with my data. I provided thick descriptions of what I did. I hope other researchers would replicate the research design, units of study, materials and methods to study other countries with gas reserves like Nigeria. As a result, newer global

initiatives and countries could be mapped as leaders in the gas governance space could be an emergence.

My research looked to systematise the global and Nigerian gas governance, showing what is there and what could be there. I secured consistency by using goals, instruments and processes to systematise both abstraction levels. My materials and rigorous analysis catalogue strengthened my research process, which involved units of action at the global and Nigerian governmental levels.

See Error! Reference source not found. for the operationalisation of my thesis.

What is there – A disconnected system with significant barriers and root origins for global and Nigerian associated gas flare governance with:

What could be there? Minimum viable global and Nigerian associated gas flare governance system with:

Insights from the analysis of 76 documents showed eleven emerging barriers

Insights from 11 international and 19 Nigerian interviews and document sources showed 8 global manifested barriers and 10 Nigerian manifested barriers

Lack of goal coherence

Lack of intelligent coordination

Lack of steady communication

Lack of sense of mutual direction

Lack of effective instruments

Lack of effective knowledge instruments

Lack of effective market instruments

Lack of effective normative instruments

Lack of effective collaboration processes

Not knowing who to collaborate with

Lack of enabling environment and willingness to collaborate

Lack of capability

Thematised and categorised as significant barriers

Thematised and categorised as root origins

Fourteen (7 each at the global and Nigerian abstraction levels) Targeted policy solutions

Goal coherence

Intelligent coordination

Steady communication

Mutual sense of direction

Effective instruments

Effective knowledge instruments

Effective market instruments

Effective normative instruments

Effective collaboration processes

Knowing who to collaborate with

Enabling environment and willingness to collaborate

Capability to collaborate

Discussion, policy solutions, recommendations and conclusions

Figure 3-2 Integrated process for a minimum viable associated gas flare governance system
Source: Author

Note: *the system could achieve greater than minimum viability (green) after the solutions are evaluated and accepted by the global and Nigerian stakeholders.*

Chapter 4   Systematised global and Nigerian associated gas flare governance

4.1   Introduction to chapter four

The literature review showed that there is a simple gap of lack of end-to-end-research that covers the systematisation of global and Nigerian associated gas flare governance. Besides, over the last decade, the problem of flaring has not been reduced. Instead, it has grown and become clustered among the top ten flaring countries of which Nigeria account for 5% of the problem. Given the knowledge gap, it is time to critically analyse the global governance system's viability, but this starts with a systemisation. In what follows I answer my first research question "how could the global and Nigerian associated gas flare governance be systematised? The first research question has three objectives.

I met my first objective "to develop a conceptual framework for systematising global and Nigerian associated gas flare governance" in **section** Error! Reference source not found.. I met my second research objective "to systematise (a) global and (b) Nigerian associated gas flare governance" in **sections 4.3** and **4.4**. I met my third research objective "(a) to chart the emerging barriers to the systematised global and Nigerian associated gas flare governance and (b) assess its minimum viability" in **section 4.5**. Finally, the summary (section **4.6**) connects this chapter to the specific manifestation of barriers and origins in Error! Reference source not found. and solutions in **Chapter 6**.

4.2   Conceptual framework for systematising associated gas flare governance

Research objective one: to develop a conceptual framework for systematising global and Nigerian associated gas flare governance: Like environmental governance, global and Nigerian associated gas flare governance can be systematised in a theoretical framework of three-parts of goals, instruments and processes (**Figure 4-1).**Error! Reference source not found. I outline my systematisation conceptual frameworks in **section** Error! Reference source not found.. In turn, I describe the conceptual frameworks for gauging barriers (**4.2.2**), testing minimum viability of the system (**4.2.3**) and framing solutions (**4.2.4**). The gauging process also includes evaluating goal coherence, effectiveness of instruments and efficiency of processes. There are likely to be barriers to the system reaching minimum viability, where policy solutions can be targeted to strengthen the system.
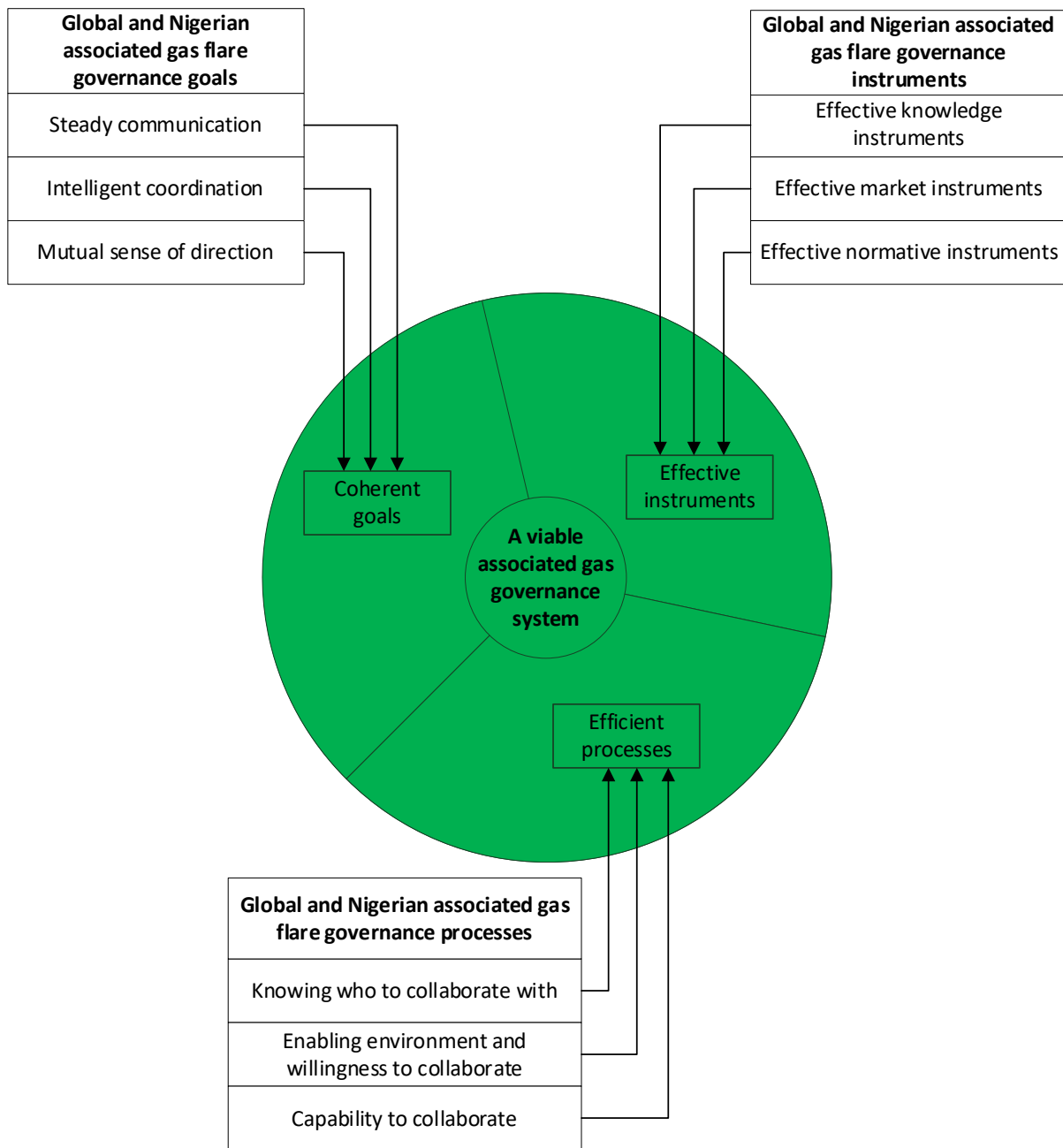
Figure 4-1 A viable global and Nigerian associated gas flare governance system

Source: Author

4.2.1   Associated gas flare systematisation conceptual framework

Back in 2006 Najam et al., systematised global environmental governance as the sum of actors, their goals, instruments and procedures to protect the environment[1]. A literature review confirmed a gap for similar systematisation of associated gas flare governance but also an opportunity to extend Najam et al frameworks into associated gas flare governance.

Coherent goals: associated gas flare governance goals, whatever they are could be systematised as coherent or incoherent and be comprised of (i) steady communication (between co-owners of a problem), (ii) intelligent coordination and (iii) a shared sense of direction (Najam et al., 2006).

Effective instruments: effective governance instrument is about effective (i) knowledge, (ii) market and (iii) normative instruments (Bemelmans-Videc et al., 1998; Paavola, 2007; Oberthür, 2009; Chasek et al., 2011; Bulkeley et al., 2012).

Efficient processes: Processes were already covered in environmental governance literature as interplay (Oberthür, 2009), but my gauging analysis may have led to new insights. I developed three concepts for systemising gas governance processes. I suggested (i) not knowing whom to collaborate with, (ii) lack of capability and (iii) lack of willingness or an enabling environment to collaborate, which I also applied to the global analysis. These processes are examined further in my discussion chapter before proposing new aspects for systematising the global and Nigerian associated gas governance processes.

These three basic frameworks, the associated origins-barriers-influences-solutions concepts could be used to determine minimum viable governance systems.

---

[1] Adil Najam, Mihaela Papa and Nadaa Taiyab, Global Environmental Governance: A Reform Agenda (Winnipeg, Manitoba: International Institute for Sustainable Development, 2006), pp. 72-76.

4.2.2 Conceptual framework for barriers to global and Nigerian associated gas flare governance

In agreement with Lee et al.[2], a barrier is a factor that prevents a governance system from reaching a minimum, viable state, and it affects other barriers and influences. I adapted a network path analysis of tracing the barriers to their root origins and influences, advancing how we consider barriers for gas governance (Lee et al. n.d). I extended the current knowledge of each of the concepts by appending the origins-barriers-influences and solutions approach to the conceptual frameworks. and gauging goal coherence, the effectiveness of instruments and efficiency of processes as a starting point.

- **Emerging barriers**: a barrier is emerging if the insights are derived from document analysis pending verification from interviews and other source.
- **Origin of barriers and root origins**: An origin is where a barrier starts an origin is a root origin related to four or more origins and/or barriers.
- **Manifested barriers**: a barrier is manifested if its existence has been confirmed through an interview by multiple sources. A significant barrier is connected to four or more barriers and influences. I used the emerging barriers from Chapter 4 to develop global and Nigerian level interview protocols.
- **Significant barrier:** a significant barrier is one with at least four connections to other barriers and influences and a root origin is one with at least four connections to other origins and barriers.
- **Influences and new(er) ways of thinking associated gas flare governance**: An influence is an outcome of a barrier. An influence is affected by a barrier. There are nine influences: three for each of the three aspects of my research (goals, instruments, and processes).

4.2.3 Conceptual framework for testing minimum viable global and Nigerian associated gas flare governance system

A governance system is minimally viable if it has coherent goals, effective instruments and efficient processes The thesis is about critique of policy at an international and national scale – with policy

---

[2] Lee, S., Dessai, S. and Paavola, J. (In review) Deeper understanding of barriers to national adaptation policy: Case of the South Korean national adaptation policy. Climate Policy.

solutions. The thesis defines associated gas flare governance system as comprising of actors, goals, instruments and processes to protect the environment from the harmful effects of flaring, while helping nation-states achieve their aims of ending associated gas flaring from a sustainability perspective**.**

The conceptual frameworks, supports the need to revisit my findings more explicitly in the conclusions and recommendations of what the two levels of abstraction tells us about understanding environmental governance and the governance of associated gas flaring. My approach of treating the units of study as units of action means my policy recommendations could be implementable by comparing what is there and what could be there. For now, I leave my reader with a summary of the key conceptual frameworks and a promise to further connect the dots at the end of the thesis.

4.2.4   Conceptual framework for solutions to barriers in global and Nigerian associated gas flare governance

The articulation of the aim and questions provides the start of a plan to supply a policy framework and enablers. This thesis also makes theoretical and empirical contributions to understanding and explaining associated gas flare governance with replicability. Furthermore, it suggests natural progressions beyond the study to enhance a global associated gas flare governance system analysis.

I used coherent goals, effective instruments and efficient processes as my fundamental conceptual frameworks. I also believe solutions-oriented actions work best to answer complex research questions. Therefore, I identified significant barriers and root origins and offered targeted policy solutions for a viable system for better associated gas flare governance.

4.3   Systematising global associated gas flare governance

Research objective two (a): to systematise global associated gas flare governance: The goals, instruments and processes of global associated gas flare governance can be systematised. However, as shown in **sections 4.3.1** to **4.3.3** there may be emerging challenges to goal coherence, effective instruments and efficient processes.

4.3.1   Global associated gas flare governance goals

As shown in **Figure 4-2**, five units of study broadly target associated gas flaring. However, their goals could be more specific. Global associated gas flare governance became mainstream in the last two decades. The Global Gas Flaring Reduction Partnership (GGFR) was set up in 2002 by the World Bank, followed in 2004 by the first version of UNFCCC Clean Development Methodology (CDM) method number AM0009. The remaining three initiatives were set up in the last decade, close to or after the COP21 Paris Agreement.

Figure 4-2 also shows the initiatives are a public-private partnership, Multilateral Environmental Agreement (MEA) or consortium-led partnership. Four global facing organisations created the initiatives. Two arise from the World Bank's effort: GGFR and the Zero Routine Flaring by 2030 (ZRF 2030), while the Global Methane Initiative (GMI) arises from a national government's effort (U.S.A.). The Oil and Gas Climate Initiative (OGCI) arises from a top-ten gas and oil companies' consortium. Finally, AM0009 is a CDM tool and stems from an MEA by the UNFCCC.

Although all the goals are quantifiable, AM0009 and GMI do not have quantified goals. Apart from ZRF[3], none has a time-bound goal. The GGFR and ZRF have ex-post and ex-ante goals due to different reasons. For example, GGFR's goal is after the fact, because of difficulties in forecasting flare reduction[4], and ZRF is before the fact due to commitments of endorsers. While the goals are commendable, they need to be assessed for coherence[5] for the integrity of the UNFCCC process[6].

---

[3]   *"Zero Routine Flaring by 2030,"* World Bank, accessed 10 May 2021, https://www.worldbank.org/en/programs/zero-routine-flaring-by-2030#5.

[4]   "Global Gas Flaring Reduction Partnership (GGFR]," World Bank, accessed 10 May 2021, https://www.worldbank.org/en/programs/gasflaringreduction#1.

[5] Adil Najam, Mihaela Papa and Nadaa Taiyab, *Global Environmental Governance: A Reform Agenda* (Winnipeg, Manitoba: International Institute for Sustainable Development, 2006), pp. 72-76.

[6] Jørgen Villy Fenhann et al., *The Climate Initiatives Platform: Towards Greater Transparency in International Cooperative Climate Initiatives (ICIs)* (Denmark: Nordic Council of Ministers, 2018), p.15 https://unepdtu.org/publications/the-climate-initiatives-platform-towards-greater-transparency-in-international-cooperative-climate-initiatives-icis/.

	GGFR	**AM0009**	**GMI**	**OGCI**	**ZRF**
Goal	Catalyst for change - reduce global flaring practices and GHG emission through policy changes, stakeholder facilitation project implementation	Support the recovery and use of associated gas that would otherwise be vented or flared through projects and increase access to carbon financing	Advance the abatement, recovery and use of methane as a viable, clean energy source and to reduce global methane emission	Increase the speed and scale of innovation of members (gas and oil companies) to reduce their GHG footprint	Secure endorsements for (1) zero routine associated gas flaring in new oil fields, (2) end legacy flaring in old oil fields and (3) report on progress
Type of goal	Specified and quantified, Ex- at 18 MtCO2 reduction in 2017	Specifiable and quantifiable, but not quantified.	Specifiable and quantifiable, but not quantified.	Specified and quantified at $1 billion committed over a decade	Specified and quantified, Ex-Ante at 400 MtCO2 by 2030
Progress against goal	Achieved 5% reduction on 350 MtCO2 baseline (18 MtCO2) in 2018.	Since 2004, 26 (out of 135) projects registered on UNFCCC database	Since, 2007, 1,100 projects set up with 40 MtCO2 reduction of methane and $600m raised	Since 2017, Members have invested $6.3 billion in low carbon research and development	65 national governments' and companies' endorsement with 41 published progress reports

Figure 4-2 Systemising the goals of the global associated gas flare governance initiatives

Source: *ZRF and GGFR sources, referenced above.*

Note: *See AM0009[7], GMI[8] and OGCI[9] references in the footnotes below.*

4.3.2   Global associated gas flare governance instruments

The overarching finding is that both knowledge and market instruments are prominent over normative instruments at the global level. I present the individual results for knowledge, market, and normative instruments in three parts.

---

[7] CDM, *Recovery and utilization of gas from oil fields that would otherwise be flared or vented Version 7.0* (UNFCCC, 2013). https://cdm.unfccc.int/methodologies/DB/ET4NXMVXFQ5C2EJL1OF8YZIEVLVDA.

[8] "Learn About the Global Methane Initiative," Global Methane Initiative (GMI) – United States Environmental Protection Agency (EPA), accessed 2021, https://www.epa.gov/gmi/learn-about-global-methane-initiative#.

[9] "We collaborate to deliver results," OGCI Action & Engagement, OGCI, accessed 10 May 2021 https://www.ogci.com/action-and-engagement/.

4.3.2.1   Global associated gas flare knowledge instruments

The findings show that Global initiatives apply simple and complex mechanisms for gas governance due to their relational-power value (**Table 4-1**).

Table 4-1 Systemising global associated gas flare knowledge governance instruments

		Associated gas knowledge governance instruments	
		Simple knowledge mechanism	*Complex knowledge mechanism*
Global initiatives	GGFR	External acquisition and sharing best practices: from six best-practice countries	Supplying support: for country-specific flaring reduction programmes
	AM0009	Developing and dissemination information: "how-to" guidance for flare-out projects	Developing and improving a method: for carbon credits
	GMI	Sharing best practices: across sectors	Matchmaking countries with technical and financing partners
	OGCI	Sharing information on innovation and running competitions	Deploying technologies and innovative business models
	ZRF 2030	Raising awareness and secure 2030 flare-out commitments and publishing progress	Complementary through GGFR

Source: *Author based on documents of the global initiatives*

Simple knowledge mechanisms

Simple mechanisms involve capturing data, processing this to/for information and knowledge exchange[10]. GGFR shares at least twenty-three knowledge products[11]. As an example of a simple knowledge mechanism, the GGFR associated gas policy guidance codifies practices from best-in-class

---

[10] Sebastian Oberthür, "Interplay management: enhancing environmental policy integration among international institutions," *International Environmental Agreements: Politics, Law and Economics* 9, 371 (2009): pp.377-378, https://doi.org/10.1007/s10784-009-9109-7.

[11] "Global Gas Flaring Reduction Partnership (GGFR]," World Bank, accessed 10 May 2021, https://www.worldbank.org/en/programs/gasflaringreduction#5.

countries for other countries to use[12] [13]. In addition, ZRF collates and publishes annual flare reports from its endorsers[14].

While ZRF could categorise its activity as Monitoring, Reporting and Verification (**MRV**), it is intricately linked to its goal-setting agenda. Notably, the ZRF affirms that this is not binding but a form of knowledge dissemination that may complement GGFR's simple knowledge mechanism. Although AM0009 sets standards, it is also a simple knowledge mechanism for capturing and using associated gas that would otherwise be vented or flared[15].

Complex knowledge mechanisms

I defined complex mechanisms as those used to create relationships and directly solve flaring problems to secure increased recovery and use of associated gas. Complex mechanisms add value beyond data transformation[16]. They have a learning and growth loop – allowing for knowledge exchange. OGCI adopts complex mechanisms by using innovative business models as a catalyst for change[17].

AM0009 is currently in its seventh version, and it involves multiple knowledge transfer routes and expert guidance[18]. GMI helps country partners develop action plans to match them with technical and

---

[12] World Bank, Regulation *of associated gas flaring and venting: a global overview and lessons from international experience* (World Bank, 2004). https://documents.worldbank.org/en/publication/documents-reports/documentdetail/590561468765565919/.

[13] GGFR*, Guidance on upstream flaring and venting: policy and regulation* (World Bank, 2009), https://documents.worldbank.org/en/publication/documentsreports/documentdetail/200701468344636937/.

[14] "Zero Routine Flaring by 2030," World Bank, accessed 10 May 2021, https://www.worldbank.org/en/programs/zero-routine-flaring-by-2030#5.

[15] CDM, *Recovery and utilization of gas from oil fields that would otherwise be flared or vented Version 7.0* (UNFCCC, 2013), https://cdm.unfccc.int/methodologies/DB/ET4NXMVXFQ5C2EJ5L1OF8YZIEVLVDA.

[16] Sebastian Oberthür, "Interplay management: enhancing environmental policy integration among international institutions," International Environmental Agreements: Politics, Law and Economics. 9(4), 2009: pp.377-378, https://doi.org/10.1007/s10784-009-9109-7.

[17] OGCI, *Catalyst for change: collaborating to realize the energy transition* (OGCI, 2017), https://www.ogci.com/wp-content/uploads/2017/10/OGCI-2017-Report.pdf.

[18] CDM, *Recovery and utilization of gas.*

financing partners for implementation[19]. Both World Bank initiatives help countries develop flare-out programmes by working in partnership with other global/international level organisations[20].

4.3.2.2 Global associated gas flare market instruments

Another finding from the analysis is that the global initiatives use market instruments to influence flare reduction and increased gas use. As shown in **Table 4-2,** the market instruments are designed and applied through three types of mechanisms.

Table 4-2 Systemising global associated gas flare market governance instruments

		Associated gas market governance instruments		
		Monetisation	*Top-down market creation*	*Bottom-up market creation*
Global initiatives	GGFR	Cost/benefits framing of the problem	Influence countries and create enabling markets	Use financing: to support solutions
	AM0009	Uses carbon credits to finance projects	Relies and benefits from carbon credit markets	Relies on DNA and DOE for local endeavours
	GMI	Monetisation of methane through projects	Increase finance access for methane-to-energy	Matches investment partners and countries
	OGCI	Monetisation of associated gas through projects	Switch to gas to power through market forces	Top-13 oil companies invest $1b/10 years
	ZRF 2030	Monetisation framing of market interventions	Argues to increase investor confidence	Makes argument to reduce cost.

Source: *Author based on documents of the global initiatives*

The monetisation of associated gas to end flaring

Monetisation involves arguing for the monetary value of alternative use of associated gas to stop flaring. All the five initiatives apply monetisation arguments to govern associated gas. For example, based on studies from Russia, Iraq and Nigeria, GGFR and ZRF posit that monetisation is a practical solution. Both these World Bank initiatives also estimated $100 billion as the cost to end global

---

[19] "GMI Project Network | Global Methane Initiative," GMI, accessed 10 May 2021, https://www.globalmethane.org/project-network/index.aspx.

[20] "Home | Nigerian Gas Flare Commercialization Programme," Nigerian Gas Flare Commercialization Programme (NGFCP), accessed 10 May 2021, https://ngfcp.dpr.gov.ng/.

flaring[21]. However, a 2004 $20 billion annual estimated savings that could have led to a five-year payback may be inaccurate even based on the current gas price[22]. The AM0009 applies carbon market principles in issuing carbon credits to reduce investment risk for flare-out projects[23].

Top-down market creation arguments

For regulation to be enforceable, it must be practical. A top-down market creation argument makes a case for these practicalities[24]. GGFR argues that countries should adopt best practices to increase investor confidence to capture and use associated gas[25]. UNFCCC applies a top-down approach through its CDM method number AM0009 to encourage increased gas recovery and use of gas that could have been flared or vented and flare-out projects[26].

Bottom-up market creation arguments

This approach creates market fundamentals through price-predictability, the certainty of demand and supply, and infrastructures' availability. It is adopted by four of the five selected initiatives, except AM0009. For example, GMI's focus is on making methane/associated gas more marketable. They share knowledge and match investment partners with countries with predefined priorities[27].

---

[21]Zubin Bamji (GGFR/ZRF 2030 Programme Manager), "We can end routine gas flaring by 2030. Here's how," World Bank Blogs, 1 March 2021, https://blogs.worldbank.org/energy/we-can-end-routine-gas-flaring-2030-heres-how.

[22] "Natural Gas," NASDAQ, accessed 10 May 2021, https://www.nasdaq.com/market-activity/commodities/ng%3Anmx. Working backwards, the World Bank calculations were based on a gas wholesale price of $4 MMBtu which may be high because gas traded at $ 2.9 /MMBtu as of 10th May 2020. Notably, the focus of this chapter is on the governance system and not the strength of the economic cases. However, flaring is a financial waste with negative sustainability impacts.

[23]CDM, *Recovery and utilization of gas.*

[24] GGFR, *Guidance on upstream flaring and venting: policy and regulation* (Washington D.C: World Bank Group, 2009), https://documents.worldbank.org/en/publication/documents-reports/documentdetail/200701468344636937/.

[25] GGFR, *Guidance on upstream flaring and venting.*

[26] CDM, *Recovery and utilization of gas.*

[27] GMI, *Oil & Gas Subcommittee Action Plan: Adopted by Subcommittee: 18 April 2018* (GMI, 2018), https://globalmethane.org/douments/OG_Subcommittee_Action_Plan_2018_Final.pdf.

OGCI focuses on innovative business models, mainly through CCUS and methane leaks, with a scant focus on associated gas flaring. However, they posit that investors require practical solutions to support initiatives to end flaring. According to OGCI, countries should develop markets to match the appetite for innovation[28]. What is missing is the direct financing of flare-out projects that AM0009 could provide. However, AM0009 has a marketability barrier, which I explore in section **4.5.2**.

4.3.2.3   Global associated gas flare normative instruments

While normative instruments involve using standards and rules, which could improve the consistency of governance instruments, only AM0009 applies it to govern (**Table 4-3)**.

Table 4-3 Systemising global associated gas flare normative governance instruments

		Associated gas market governance instruments		
		Command and control	*Hard targets*	*Standards-setting*
Global initiatives	GGFR	Not applicable	Not applicable	Not applicable
	AM0009	Strict monitoring and enforcement process	Voluntary implementation but hard targets	Step by step to justify project sustainability
	GMI	Not applicable	Not applicable	Not applicable
	OGCI	Not applicable	Not applicable	Not applicable
	ZRF 2030	Not applicable	Not applicable	Not applicable

Source: *Author based on documents of the global initiatives*

The UNFCCC Executive Board governs through a command-and-control system with inputs from the Designated National Authorities (**DNA**) and Designated Operating Entities (**DOE**) as its hierarchical tiers of governance[29]. Furthermore, the application of a step-by-step process to award carbon credits is evidence of standards setting[30].

Notably, while a lack of political authority may explain the reluctance of global initiatives to apply normative instruments in governance, there could be other explanatory factors. GGFR leaves

---

[28] OGCI, *Catalyst for change*

[29] "CDM: Designated National Authorities (DNA)," UNFCCC, accessed 10 May 2021, https://cdm.unfccc.int/DNA/index.html.

[30] "CDM: Executive Board (EB)," UNFCCC, accessed 10 May 2021, https://cdm.unfccc.int/EB/governance.html.

normative instruments to countries, citing a lack of effective regulation[31] but potentially missing an opportunity to influence country-level standards-setting for associated gas flare governance. ZRF 2030 argues for a country-by-country approach due to contextual barriers[32].

As a consortium, OGCI members undertake individual flare-out initiatives[33]. GMI works multilaterally through its networks[34]; therefore, it is unlikely to adopt normative instruments. The main emerging barrier is a missed opportunity to secure consistency in using standards setting as a precursor to normative instruments, globally and potentially at country levels.

4.3.3   Global associated gas flare governance processes

Based on the systemisation of processes to govern associated gas flare, the findings in **Table 4-4** show that the global initiatives prefer a partnership process to an independent process. However, there seemed to be no intra-initiative partnership processes. As a reminder, a partnership process involves horizontal and vertical collaboration, emphasising both; however, the independent process focuses on vertical coordination alone[35].

While there are within-initiative partnerships, it is not happening at the same level as cross-initiatives partnerships. Given the similarities in their goals, it is surprising that there was few evidence of a cross-initiative partnerships. Arguably, the totality of initiatives could supply a comprehensive solution. However, except for the two World Bank initiatives, there was no evidence of cross-initiative

---

[31] GGFR, *Guidance on upstream flaring and venting.*

[32] "Q&A. Zero Routine Flaring," ZRF, accessed 10 May 2021, https://www.worldbank.org/en/programs/zero-routine-flaring-by-2030#7.

[33] "About OGCI | Collaborating for climate change | Our members. Guiding principles and commitment," OGCI, accessed 10 May 2021, https://www.ogci.com/about-us/#guidingprinciples.

[34] GMI, *Terms of Reference | Global Methane Initiative* (GMI, 2014), https://www.globalmethane.org/terms/index.aspx.

[35] Oberthür, "Interplay management."

coordination and sharing resources. An intra-initiative limited resource sharing is analysed as an emerging barrier in section **4.5.3** and manifested barrier in section **5.3.3**.

Table 4-4 Systemising global associated gas flare governance processes

	GGFR	UNFCCC AM0009	GMI	OGCI	ZRF 2030
Hierarchical tiered or loosely coupled membership?	Loosely coupled Public-Private Partnership.	Three levels, hierarchical and tiered structure.	Loosely couple membership of networks	Loosely coupled membership of oil companies.	Loosely coupled membership by endorsement
Use penalties or enforce goals?	No penalties	Hard targets for credits.	No penalties	No penalties	Unenforceable commitment
Horizontal and vertical coordination?	Horizontal and low vertical coordination	More vertical than horizontal coordination	Horizontal and vertical coordination	Mostly horizontal coordination	Horizontal and some vertical coordination
Sharing resources with the other four global initiatives?	With ZRF 2030				
Direct, collaboration with the other four global initiatives?	ZRF 2030 and OGCI	GGFR		GGFR and ZRF 2030	GGFR and OGCI
Type of governance process	*Partnership*	*Hybrid: partnership and independent*	*Partnership*	*Partnership*	*Partnership*
Legend					
🟥	No evidence				
🟧	Partial or incomplete evidence				
🟩	Strong evidence				

Source: *Author, compiled from multiple sources*

Both World Bank initiatives have an agreement with the Global Infrastructure Facility (**GIF**) to supply $500,000 non-reimbursable pre-feasibility project financing for ZRF endorsers[36]. Project equipment procurement is under the World Bank rules through the above tripartite process, providing a market governance mechanism. However, this cooperation is under the safety net of the World Bank Group. Unsurprisingly, the evidence of an independent implementation came from the AM0009. While the UNFCCC portrays its governance as collective, the Executive Board controls these actions through a central platform[37]. Besides the DNA supply, national-level governance and the DOE supply technical inputs all within pre-agreed standards.

4.4   Systematising Nigerian associated gas flare governance

Research objective two (b): to systematise Nigerian associated gas flare governance: Like the global level, but reflecting decades of neglect to hydrocarbon governance, the Nigerian associated gas flare governance can be systematised as goals, instruments and processes. But as show in **sections 4.4.1** to **4.4.3**, the goals may be incoherent, instruments may be ineffective and processes may be inefficient.

4.4.1   Nigerian associated gas flare governance goals

Since 1959, Nigeria has undergone four gas governance transformations. See **Figure 4-3**. In the first phase, although flaring was illegal[38], it continued due to arbitrarily awarded flare exemption certificates and unclear regulation resulting from four changes of the government machinery[39]. In the second phase, there were notable signs of progress with the creation of a Climate Change Unit and

---

[36] World Bank, *Gas Flaring and Venting Monetization Project: Call for Project Proposal Ideas - Annex 1, description* (World Bank, 2017), https://pubdocs.worldbank.org/en/451381508520436103/pdf/Annex-1-Description-Call-for-Project-Proposal-Ideas.pdf.

[37] "CDM: Panels / Working Groups / Teams," UNFCCC, accessed 10 May 2021, https://cdm.unfccc.int/Panels/index.html.

[38] Associated Gas Re-injection Act of 1975. See Nigeria Gas Flare Commercialisation Programme [NGFCP] and Other Related Regulations, https://ngfcp.dpr.gov.ng/media/1065/associated-gas-reinjection-act.pdf.

[39] "History – Department of Petroleum Resources," DPR, accessed 10 May 2021. https://www.dpr.gov.ng/history-of-dpr/.

Nigeria's first National Communication to the UNFCCC[40]. However, too many regulators, lack of capability and market instruments were persistent barriers to better governance of associated gas flaring[41]. The third phase saw greater gas governance actions, including introducing a Nigerian Extractive Transparency Initiative (**NEITI**) Act[42], an attempt at passing a Petroleum Industry Bill (**PIB**), and creating a Department for Climate Change and a Climate Policy[43]. The fourth phase saw the ratification of Nigeria's NDC[44]. There was also the introduction of a flare commercialisation programme[45] and the first dedicated National Gas Policy[46]. However, the Nigerian government secured the national gas policy through an Executive Order due to a lack of gas-specific legislation. As shown in section **4.5.2**, the use of an Executive Order could be an emerging barrier.

---

[40] Michal Nachmany et al., *The GLOBE climate legislation study: a review of climate change legislation in 66 countries* (Grantham Research Institute on climate change and the environment, 2014), p.421, https://www.lse.ac.uk/granthaminstitute/publication/the-globe-climate-legislation-study-a-review-of-climate-change-legislation-in-66-countries/.

[41] 'Gbite Adeniji, *Gas Sector Reforms in Nigeria* (Advisory, 2014), https://www.advisoryng.com/wp-content/uploads/2019/02/2012.02.16.-GAS-SECTOR-REFORMS-CPPA.pdf.

[42] Nicolas Shaxson, Nigeria's *Extractive Industries Transparency Initiative: Just a glorious audit?* (Chatham House, 2009), https://eiti.org/files/documents/NEITI%20Chatham%20house_0.pdf.

[43] Nachmany et al., p 421

[44] Federal Republic of Nigeria, *Nigeria's Second National Communication under the UNFCCC* (2014), https://unfccc.int/resource/docs/natc/nganc2.pdf.

[45] "Home | Nigerian Gas Flare Commercialization Programme."

[46] Federal Republic of Nigeria, *National Gas Policy - Nigerian Government Policy and Actions* (2017), https://ngfcp.dpr.gov.ng/media/1059/national-gas-policy-approved-by-fec-in-june-2017.pdf.

1st phase: 1959-2000	→	2nd phase: 2001-2006	→	3rd phase: 2007-2014	→	4th Phase: 2015 onward

Petroleum Act 1969

But, high focus on oil and hardly any focus on associated gas and flaring

Gas Re-injection Act of 1969

But, flaring exemptions certificates were issued

First national report to the UNFCCC (2003)

Kickstarted associated gas flare governance actions but through Executive Orders

Gas Development agreements

But, lacked legislative support

Gas strategy 2005

Brought in strategic gas reform

Petroleum Industry Bill

But failed to pass as a law as did Petroleum Industry Governance Bill

2007 NEITI Act

Increased transparency **but focused** on oil revenue

Gas Master Plan

1st gas blueprint, **but not** updated in 2017 Gas Policy

Gas Regulation 2018

To fill loopholes in existing legislation and implement associate gas flare commercialisation programme

2017 Gas Policy

1st dedicated gas policy and introduced Norwegian model; to streamline policy, regulation & commercial processes

NDC Ratification

NDC enhancement through for COP26

Petroleum Industry Bill version 2.0

Aimed at creating a gas enabling legislation but did not address reasons for failure of version 1.0

Figure 4-3 Institutional evolution of Nigeria's associated gas flare governance system

Source: *Author*

Notably, 40% of the savings from Nigeria's NDC links to ending flaring and better associated gas flare governance[47]. According to Nigeria, ending flaring by 2030 and efficient gas-to-electricity generators could deliver a total of 165 MtCO (63 $MtCO_2$ and 102 $MtCO_2$) [48]. Therefore, its NDC is an unconditional commitment of 20% (180 $MtCO_2$) and a 45% (405 $MtCO_2$) conditional reduction. Given Nigeria's gas reserves, this is not surprising. Nevertheless, challenges include fulfilling local demand, which requires gas distribution infrastructures that Nigeria does not have[49]. However, the result also led to three

---

[47] Federal Republic of Nigeria, Nigeria's *Second National Communication under the UNFCCC* (2014) https://unfccc.int/resource/docs/natc/nganc2.pdf.

[48] Federal Republic of Nigeria, *Approved Nigeria's INDC* (UNFCCC/Nigerian Ministry of Environment, 2015), p.2, https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Nigeria%20First/Approved%20Nigeria%27s%2 0INDC_271115.pdf.

[49] Adeniji, *Gas Sector Reforms.*

emerging barriers into Nigeria's associated gas flare governance goals which are latter explored in section **4.5.1**.

First, Nigeria planned to secure financing from its gas flare commercialisation programme. According to the Carbon Brief, at least $500 million could be generated[50] through Nigeria's gas commercialisation programme. Besides, the programme claims, Nigeria could meet 13 of the 17 SDGs through flared-gas commercialisation[51] (except for 2, 6, but potentially SDG 14 and 15). Second, the programme's success depends on an ineffective right to seize flared associated gas[52] . Although strengthened through a Flare Gas Regulation in 2018, it may still be a weak claim that Nigeria can seize flared associated gas[53]. Third, there is an expectation of collaboration by eight government agencies to deliver the commercialisation programme[54], which points to the emerging barriers.

4.4.2   Nigerian associated gas flare governance instruments

Table 4-5 systematises Nigeria's gas governance instruments encompassing five documents, a programme and an initiative. Each of these is described and feeds into the systemisation of Nigeria's associated gas flare knowledge, market and normative instruments that follows.

Table 4-5 Systemising Nigeria's associated gas flare governance instruments

	Type of instrument		
	Knowledge	*Market*	*Normative*
Nigerian Petroleum Industry Bill version 2			
Nigerian Flare Gas Regulation 2018			

---

[50] Daisy Dunne, *The Carbon Brief Profile: Nigeria. Carbon Brief: Clear on Climate* (Carbon Brief, 2020), https://www.carbonbrief.org/the-carbon-brief-profile-nigeria.

[51] NGFCP, (2020) *Nigerian Gas Flare Commercialisation Programme "The Journey So Far & Next Critical Steps"*. A Presentation to the Honourable Minister of Niger Delta Affairs.

[52]   Wole   Obayomi,   *Highlights   of   the   Flare   Gas   (PWP)   Regulations*   (KPMG,   2018), https://home.kpmg/ng/en/home/insights/2018/10/Highlights-of-the-Flare-Gas-Prevention-of-Waste-and-Pollution-Regulations-2018.html.

[53] Federal Republic of Nigeria, *Flare Gas (Prevention of Waste and Pollution) Regulations 2018 – Policies* (IEA), accessed   10   May   2021,   https://www.iea.org/policies/8675-flare-gas-prevention-of-waste-and-pollution-regulations-2018.

[54] NGFCP, "The Journey So Far & Next Critical Steps."

Instrument			
Nigerian Gas Policy 2017	Green	Green	Light Green
Nigerian Gas Flare Commercialisation Programme 2016	Green	Green	Light Green
Nigerian NDC 2015	Green	Green	Light Green
NEITI Act 2007	Green	Light Green	Light Green
Nigerian Climate Change Policy 2013	Green	Green	Light Green
Nigerian Gas Master Plan 2007	Red	Red	Red
Nigerian Associated Gas Re-Injection Act, (1979 and 1984)	Red	Red	Red
Nigerian Petroleum Act (1959 and 1969)	Red	Red	Red
Legend			
Green	Directly categorised as either knowledge, market or normative and it is currently relevant		
Light Green	Indirectly categorised as either knowledge, market or normative and it is currently relevant		
Red	Superseded by another instrument covered here		

Source: *Author from various Nigerian gas governance documents*

Note: *I considered but discounted other instruments because they were superseded. The discounted instruments include Gas Masterplan (2007), Associated Gas Re-injection Act (1969, 1879 and 1984) and Petroleum Act (1959 and 1969).*

Nigerian Petroleum Industry Bill: It is a proposed normative instrument with little chance of becoming an effective legislation. The President and the Legislators disagree on the bill's contents, which negatively affects gas infrastructure investments[55]. The rational investor places a premium on contractual rights enshrined in legislation. A lack of gas-specific legislation could have led to over $120 billion lost investment over eight years[56]. Furthermore, without the PIB, the gas commercialisation goals are at risk, which means a lower possibility of realising the 40% of savings from Nigeria's NDC linked to ending flaring and better gas governance.

---

[55] Paul Carsen, "UPDATE 1 - Nigeria's presidency rebuffs landmark oil reform bill in current form," Reuters, 29 August 2018, https://www.reuters.com/article/nigeria-oil-idUSL3N1VJ55M.

[56] NEITI, Policy *briefs - The Urgency of a New Petroleum Sector Law. Nigerian Extractive Industries Transparency Initiative* (NEITI, 2016), https://neiti.gov.ng/index.php/2017-07-27-13-55-55/policy-brief.

Nigerian Flared Gas Regulation (2018): It was designed as a normative instrument to fill the loopholes in the Petroleum Act (1959, amended in 1969)[57], to seize and auction flared gas from oil producers. Although the DPR claims that Nigeria has the right to seize flared gas in the 1969 Petroleum Act (normative instrument), this is doubtful given its lack of recency. Without the right to seize and auction, the flared gas commercialisation programme may be at risk. Section 2 of the regulation stipulates that:

"The Federal Government will take natural gas produced with crude oil free of cost at the flare and without payment of penalty"[58].

However, oil producers claim that the "Field Development Programme of National Petroleum Management Services, an NNPC subsidiary",[59] already covered gas-flare sites in the commercialisation programme's portfolio. Therefore, there is a risk without an explicit right to seize and auction the flared gas at subsidised prices[60]. Besides, the unattractive economics of gas threatens the gas flare commercialisation programme's viability.

Nigerian Gas Policy (2017): The policy has aspects of knowledge and market instruments but also emerging barriers. For example, knowledge aspects include pricing models, and market aspects include fiscal and commercial frameworks and infrastructure blueprints[61]. However, the policy is not sustainable as it lacks a legislative guarantee to supply the framework needed for effective regulation[62]. See **section 5.4.1.1**. for further manifestation of this barrier beyond its emergence in **section 4.5.2**.

Nigerian Gas Flare Commercialisation Programme: The programme plans to seize flared gas and auction it to willing third-party investors[63], but this is a weak claim. Although launched in December

---

[57] Obayomi, 2018.

[58] Federal Republic of Nigeria, 2018.

[59] Obayomi, 2018.

[60] NGFCP, "The Journey So Far & Next Critical Steps."

[61] Federal Republic of Nigeria, *National Gas Policy,* pp. 42-48

[62] GGFR*, Guidance on upstream flaring and venting*, p. 5.

[63] NGFCP, "The Journey So Far & Next Critical Steps."

2016, the procurement process only started in 2018 and was ongoing as of December 2020[64,] showing a protracted process. The programme's primary goal is to implement Nigeria's National Gas Policy of 2017 to end associated gas flares in the near term (2-3 years). There is also a gas-based industrialisation outcome. However, for the programme to be successful, investors would require accurate data than currently available.

Nigerian Climate Change Policy 2017: The UNFCCC sponsored an international capability programme to enhance Nigeria's NDC[65]. This insight forms a key part of my analysis as it was challenging to find and analyse climate action documents. Interestingly, there is the outstanding issue of a lack of capability. In addition, the analysis of the capability programme (**Table 4-14**) surfaces barriers of lack of collaboration between government departments and systems thinking, which I further explored in **section 4.5.3.**

NEITI Act 2007: NEITI is a Nigerian branch of the global Extractive Industries Transparency Initiative (**EITI**). NEITI is focused on Nigeria's governance in the oil and gas and extractive industry. While their mandate covers the extractives industry, it is unclear how they encourage collaboration between government departments[66]. They have focused on the transparency of oil revenue in the past. However, NEITI is now considering a shift in focus that could be critical for targeted policy solutions, which this thesis supplies.

I used the insights from above for the systemisation of Nigeria's associated gas flare governance instruments (knowledge, market, and normative). The chequered nature of developing Nigeria's gas governance instruments means that the systemisation highlights potentially more emerging barriers than were found for the global level. However, this finding does not immediately mean the Nigerian abstraction level is worse than the global level. I recognise the risk of my positionality (as a Nigerian), so I added greater rigour to the analysis, balancing sensitivity and sense checking reality.

---

[64] "Frequently Asked Questions. Nigerian Gas Flare Commercialisation Programme," NGFCP, accessed 10 May 2021, https://ngfcp.dpr.gov.ng/resources/frequently-asked-questions/.

[65] "Nigeria – Overview," NDC Partnership, accessed 10 May 2021, https://ndcpartnership.org/countries-map/country?iso=NGA.

[66] NEITI, *Strategic Plan (2017-2021)* (NEITI, 2017), https://neiti.gov.ng/index.php/aboutus/the-strategic-pl

4.4.2.1   Nigeria's knowledge instruments

Perhaps the most compelling finding is that Nigeria has only a few knowledge instruments for governing its associated gas flaring (as defined in this thesis). Even these are not fully developed. The Nigerian Gas Policy of 2017 claims to adopt best practices. However, while it is Nigeria's first dedicated gas policy, there are emerging barriers. For example, while there is evidence for integrating energy planning into gas governance, the same cannot be said for climate change and the environment[67].

Furthermore, while the 2017 policy covers a pricing framework[68], it may not be to the extent needed for effective economic valuation of associated gas[69]. Moreover, while there is an intent to collaborate for effective governance processes[70], these would need to be assessed against other sources for validity and implementation.

Although the gas flare commercialisation programme targeted [170] flare sites to convert between 70 to 90 of them to gas-to-power projects within two years[71], there are knowledge gaps. While the programme claimed that Nigeria could meet its zero-routine target by 2020, this was just a rallying cry like ZRF 2030. Also, the nature of the government's role is unclear. Attracting investors would require supplying correct data for flare sites. However, it is doubtful that Nigeria has created a platform needed to provide accurate data.

Aside from the NDC and request for capability building, I could not find any knowledge instruments for climate actions. Furthermore, the DPR has informed bidders that climate or development finance

---

[67] Federal Republic of Nigeria, *National Gas Policy*, pp. 32-34.

[68] Federal Republic of Nigeria, *National Gas Policy*, pp. 44-46.

[69] GGFR, *Regulation of associated gas flaring and venting : a global overview and lessons from international experience* (Washington D.C: World Bank, 2004), https://documents.worldbank.org/en/publication/documents-reports/documentdetail/590561468765565919/.

[70] Federal Republic of Nigeria, *National Gas Policy,* pp. 88-98.

[71] "Our Vision | Nigerian Gas Flare Commercialization Programme," NGFCP, accessed 10 May 2021, https://ngfcp.dpr.gov.ng/about-us/our-mandate/our-vision/.

is unlikely despite their promises during the programme's early phase[72]. As of December 2020, there are now only 40 sites in the programme basket, despite 70 to 90 being promised, crystalising the fear of lack of transparency or accurate data[73].

4.4.2.2 Nigeria's market instruments

Another result of the analysis is that Nigeria's associated gas flare market instruments are still in the development phase. Effectively designed market instruments could encourage better associated gas utilisation[74], which Nigeria seemed to have achieved in design principles in its 2017 gas policy[75] and commercialisation programme. However, the 2017 gas policy analysis shows emerging barriers in critical areas, for example, third-party access, which reduces barriers to entry[76]. However, the analysis shows outdated third-party access provisions; there was only one reference to a future date for addressing the third-party access barrier[77]. Third-party access seems to be reliant on operators' goodwill. Furthermore, while there is an acknowledgement of outdated infrastructure blueprints, the 2017 policy relies on the 2007 gas master plan blueprints[78].

The gas flare commercialisation programme is a market instrument, but a historic opportunity may be lost because raising finance is doubtful. Nigeria commenced implementing the flared-gas commercialisation programme as one of the initiatives to foster efficiency and attract investments[79]. The programme aims to end gas flaring through flare-out projects developed by competent third-party investors selected from competitive and transparent procurement. Flared gas needs to be seized and

---

[72] *NGFCP, Frequently Asked Questions* (NGFCP, 2019), https://ngfcp.dpr.gov.ng/resources/frequently-asked-questions/.

[73] NGFCP, *Frequently Asked Questions*.

[74] GGFR, *Regulation of associated gas flaring and venting.*

[75] Federal Republic of Nigeria, *National Gas Policy,* pp. 46-48.

[76] GGFR, *Guidance on upstream flaring and venting.*

[77] Federal Republic of Nigeria, *National Gas Policy,* p. 43.

[78] Federal Republic of Nigeria, *National Gas Policy*, pp. 65-66,

[79] Federal Republic of Nigeria 2017, National Gas Policy, p. 13.

auctioned to willing third-party investors at subsidised prices for the programme to succeed[80]. However, as shown earlier, the right to seize flared gas is doubtful. As a result, Nigeria relies on weak market instruments in the broader gas governance system, which may be ineffective.

4.4.2.3 Nigeria's normative instruments

Another finding is a lack of gas-specific legislation and ineffective normative associated gas flare governance instruments. The flared-gas regulation of 2018 seems to be the only up-to-date normative instrument. Nigeria has only one climate change law, compared to five in South Africa, three in Algeria, two in Angola and four in Ghana and no litigation for flaring[81]. The number of laws does not matter; instead, it is a question of their effectiveness as normative instruments. Notably, the only climate change litigation was between a private citizen and Shell Petroleum and the Nigerian government to declare flaring unconstitutional, despite being illegal[82]. Without normative climate action instruments, policies lack traction in their governance application.

In addition to the lack of gas-specific legislation, the analysis found other emerging barriers. Nigeria needs up-to-date, gas-specific legislation. While it could be a framework that lays the foundation for detailed policy and regulation[83], Nigeria relies on the 1969 Petroleum Act. The 2017 gas policy recognises this failure; however, it only states a plan for new legislation[84] despite over two decades of delay. Notably, the Ghanaians, learning lessons from Nigeria, passed their gas bill into law within two years (2014 – 2016)[85]. A persistent barrier has been too many regulators and the **NNPC** acting as both a referee and a player[86]. The 2017 gas policy acknowledged the problem of multiple regulators

---

[80] "Home | Nigerian Gas Flare Commercialization Programme," NGFCP, accessed 10 May 2021, https://ngfcp.dpr.gov.ng/.

[81] "Climate Change Laws of the World: Nigeria," Grantham Institute, accessed 10 May 2021, https://climate-laws.org/geographies/nigeria.

[82] "Climate Change Laws of the World: Nigeria."

[83] GGFR, *Guidance on upstream flaring and venting.*

[84] Federal Republic of Nigeria 2017, *National Gas Policy,* pp. 31; 60-65.

[85] NRGI, *Ghana's Petroleum Exploration and Production Bill: Steps Forward, But Room for Improvement* (Natural Resource Governance Institute, 2015), https://resourcegovernance.org/blog/ghanas-petroleum-exploration-and-production-bill-steps-forward-room-improvement.

[86] Federal Republic of Nigeria 2017. National Gas Policy, p. 33; 60-65.

and proposed a single regulator. However, implementation of the proposed has stalled due to a lack of primary legislation.

A country should be clear about what to do with gas in new fields and end routine flaring, but that may not be the case for Nigeria. Two best practice countries for ending flaring are Canada (Alberta) and Norway[87]. In Alberta, associated gas use is mandatory. Norway only approves new field development if the proposal has an acceptable associated gas-use solution. In the case of what to do with gas, the 2017 policy only supplies a statement of intent to introduce new regulations. However, the Flare Gas Regulation 2018 signals a willingness to enforce what to do with associated gas, but there are questions of its practicalities[88].

Regardless of the type of regulation, flaring should be the least attractive choice[89]. However, it seems that although Nigeria has increased its flare penalty to $2.5 per s.c.f, it has not yet found the right level of penalty. Norway's penalty of $120/1000m³ encourages oil operators to invest in developing innovative procedures to reduce non-routine associated gas flaring[90]. While the 2017 policy[91] increased Nigeria's penalty from N10 per s.c.f (U.S.D. $0.03) to $2 per s.c.f, and then $2.5 in the Flare Regulation 2018[92], it is still 48 times less than is applicable in Norway.

The low penalty regime in Nigeria and less strict enforcement could mean the oil companies prefer to pay to flare associated gas rather than invest in expensive infrastructures in an uncertain investment environment. However, Nigeria does not have the considerable sovereign wealth of the Norwegians, or its institutions of governance needed to be as strict in regulation.

---

[87] GGFR, *Guidance on upstream flaring and venting*.

[88] Federal Republic of Nigeria, Flare *Gas (Prevention of Waste and Pollution) Regulations 2018*.

[89] GGFR, *Guidance on upstream flaring and venting.*

[90] GGFR, *Guidance on upstream flaring and venting.*

[91] Federal Republic of Nigeria, National *Gas Policy*, p. 63.

[92] Federal Republic of Nigeria, Flare *Gas (Prevention of Waste and Pollution) Regulations 2018.*

4.4.3   Nigerian associated gas flare governance processes

Another finding is that Nigeria is not yet clear about its processes to govern gas. As shown in what follows, there is an ongoing plan to implement the Norwegian model for gas governance (but not for climate action). Besides, the coordination process between gas and climate regulators is not straightforward.

4.4.3.1 Nigeria's adoption of the Norwegian model

Nigeria formally adopted the Norwegian model in 2017 through the National Gas Policy to manage its gas governance process. The model calls for the separation of policy, regulatory and commercial functions. What is surprising is that the model seemed to have been adopted without the required capability.

I define "capability" in my thesis as the knowledge and the ability to govern. Notably, expected coordination between gas and environmental regulators is hardly happening. However, there is a keen recognition by MoE's DCC (the environment, not the gas regulator) of a lack of capability to be addressed through international collaboration (see **Table 4-14**). However, the design of the capability development programme may pose a barrier to a better gas governance process.

Nigeria has tried to adopt the Norwegian model to separate its policy, regulatory and commercial processes[93]. The 2017 gas policy proposed implementing the model as outlined in **Figure 4-4**. A restructured MPR would focus on policymaking to reduce the number of regulators. This reduction in the number of regulators created over the years led to an unattractive investment environment, acknowledged in the 2017 gas policy as a persistent barrier[94].

The 2017 policy proposed a merger of existing regulators to create a new single regulator, the National Petroleum Commission (**NPC**). In addition, the policy proposed creating two new commercial organisations, the Nigerian Petroleum Asset Management Company (**NAPAMC**) and the Nigerian

---

[93] Mark C. Thurber, David R. Hult and Patrick Heller, "Exporting the 'Norwegian Model': The effect of administrative design on oil sector performance" *Energy Policy* 39(9), September 2011: p.5367. https://doi.org/10.1016/j.enpol.2011.05.027.

[94] Federal Republic of Nigeria 2017, *National Gas Policy*, pp. 35-40.

Petroleum Company (**NPC**). These two new commercial organisations would tackle a lack of commercial capability by the NNPC. However, as shown in the next section, Nigeria may lack the capabilities to implement the Norwegian model for better gas governance successfully.

4 Key requirements of the Norwegian model
1. A distinct separation of Policy, regulation, and commercial functions; but with the presence of require4d capability.
2. Fairness between public and private players.
3. Integrity of the system & checks and balances.
4. Transparency of the system.

Policy
Ministry of Petroleum Resources
MPR

Separation of policy and regulation functions from the commercial function

Regulation
Nigerian Petroleum Commission
NPC

Commercial
Nigerian Petroleum Company (NPC) and Nigerian Petroleum Asset Management Company (NAPAMC)

Oil and gas companies
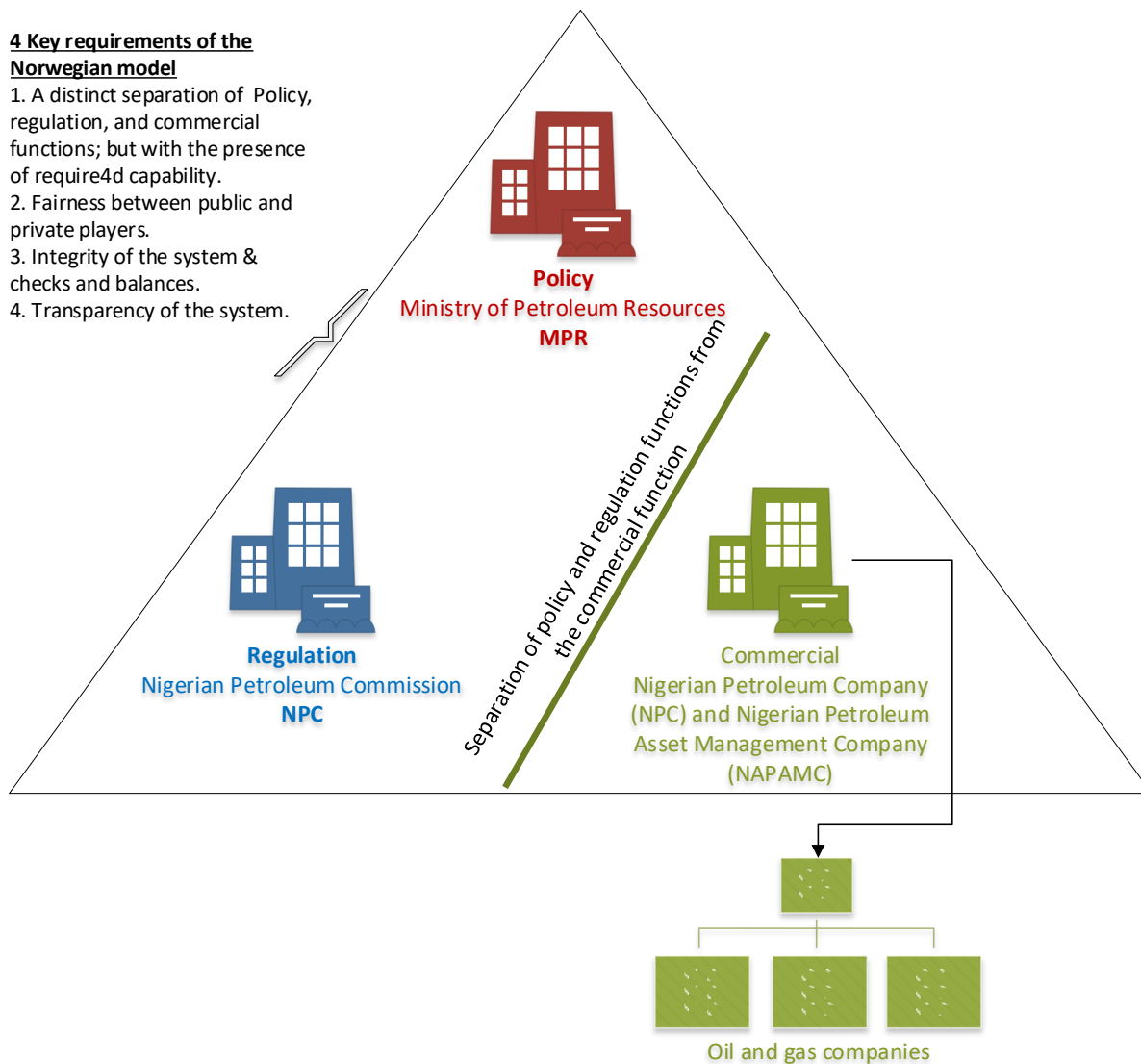
Figure 4-4 Nigeria's adoption of the Norwegian model for hydrocarbon governance

Source: *Thurber et al. (2011) and FRN (2017) Nigerian National Gas Policy*

4.4.3.2 Nigeria's coordination of associated gas flare governance process

Regarding the general coordination of associated gas flare governance processes, national coordination is needed between gas and climate regulators to reduce regulatory complexities[95]. However, the findings from the analysis show five potential insights for emerging barriers.

First, there could be better coordination between the gas regulator and cross-coordinating arms of government such as the environment, finance and energy[96]. This coordination could specifically be between the DCC (an agency of the Environmental Ministry) and the DPR, as the industry regulator and host of the gas flare commercialisation programme. However, the analysis shows emerging barriers, including a lack of capability and lack of collaboration.

Second, whichever form the industry regulator takes, its important roles are clear. Besides, the regulator should be independent of politics[97]. However, this is not the case for Nigeria. While the 2017 gas policy proposed a National Petroleum Commission (**NPC**) as a single regulator, a lack of gas-specific legislation means no progress[98]. From the analysis, it looks like there are currently at least two gas regulators. These include the DPR and the NNPC.

Third, there has also been concern about the independence of the proposed single regulator and claims of continued political interference due to its reporting structure[99]. In addition, the 2017 gas policy or any other national documents analysed did not supply the responsibilities of the proposed single new regulator. This oversight means it is challenging to figure out its potential capability. While

---

[95] GGFR, *Guidance on upstream flaring and venting*.

[96] NRGI, *Natural Resource Charter 2nd ed*. (Natural Resources Governance Institute, 2014), pp. 8-9. https://resourcegovernance.org/approach/natural-resource-charter#.

[97] GGFR, *Guidance on upstream flaring and venting*.

[98] Federal Republic of Nigeria 2017, *National Gas Policy,* pp. 14 & 36.

[99] KPMG, *The Petroleum Industry Governance Bill* (KPMG, 2017), https://assets.kpmg/content/dam/kpmg/ng/pdf/tax/ng-kpmg-newsletter-on-the-petroleum-industry-governance-bill.pdf.

arguments of diseconomies may hold against having a single regulator, it could lead to effectiveness and transparency if backed with clear responsibilities[100].

Fourth, my analysis also found concerns about the DCC capability to reduce flaring and increase gas utilisation. The DCC could actively contribute to policies and regulations with climate change impact, such as reducing flaring and utilising gas[101]. However, I could not find any substantive policy documents relating to flaring on their website[102]. This result raised concerns about the role of the environmental regulators and climate change. However, a counterfactual is that the DCC has requested capability building support from the NDC Partnership[103] (**Table 4-14**). I recognised the effort to develop such an endeavour and the potential for greater insights. Therefore, I explore this finding further in section **4.5.3**.

Fifth, the gas flare commercialisation programme was incubated at the MPR but now sits at the DPR, which is supposed to be one of the gas sector regulators. However, in addition to the four-year procurement process experienced by investors, there seem to be other emerging barriers. For example, excessive delays constrained the procurement process. As of December 2020, there were still ongoing procurement-related questions and answers, showing delays in completing the programme[104].

Next, I supply further insights on the 11 emerging barriers which made it challenging to systematise the global and Nigerian associated gas flare governance.

---

[100] KPMG, *The Petroleum Industry Governance Bill.*

[101] GGFR, *Guidance on upstream flaring and venting*, pp. 8-9.

[102] "Download Documents/Publications," Department of Climate Change (DCC), accessed 10 May 2021, https://climatechange.gov.ng/national-policy-on-climate-change/.

[103] "Nigeria - Overview." NDC Partnership, accessed 10 May 2021, https://ndcpartnership.org/countries-map/country?iso=NGA.

[104] NGFCP, *Frequently Asked Questions. Nigerian Gas Flare Commercialisation Programme.*

4.5   Emerging barriers for the systematised associated gas flare governance

Research objective three: (a) to chart the emerging barriers to the systematised global and Nigerian associated gas flare governance: As shown in **Table 4-6,**Error! Reference source not found. 11 emerging barriers, mean that both the global and Nigerian associated gas governance systems cannot be systematised into one system. Notably, the fact that there are too many emerging barriers points to the possibility that a connected single system is nonsensical.

Table 4-6 Emerging barriers for associated gas flare governance

Emerging barriers	Abstraction		Concepts		
	Global	*Nigerian*	*Goals*	*Instruments*	*Processes*
#1 Lack of proportionality and specificity	■		■		
#2 Interlinked conditional goals, and lack of legislation		■	■	■	
#3 Lack of published information		■	■	■	
#4 Lack of fundamentals in the 2017 Nigerian gas policy		■	■	■	
#5 Lack of infrastructures and commercial frameworks		■		■	
#6 Standalone instruments, lack of norms and financing	■	■		■	
#7 Duplication of activities	■	■			■
#8 Weak knowledge management processes	■				■
#9 Lack of capability		■			■
#10 Lack of systems thinking	■	■			■
#11 Fragmented gas governance process in Nigeria		■			■
Legend					
■ Emerging barrier at the global or Nigerian level or the three parts of the conceptual frameworks					
■ Emerging barrier that cuts across the abstraction levels or parts conceptual frameworks					

Source: Author

These emerging barriers occur at the global and or Nigerian level and are related to goals, instruments and processes. For example, two emerging barriers cut across both levels: a standalone market instrument and failure to create norms and a lack of development finance. Also, a lack of systems

thinking, and duplication of activities seems to happen at both the global and Nigerian abstraction levels.

The systemisation of the global associated gas flare governance goals led to two emerging barriers that may point to a lack of goal coherence. Notably, not all five global initiatives actively sought to directly tackle the two-part problem: ending flaring and increased gas use. Besides, there may be active contradictions and misalignment of goals that I surface from further investigation. There are issues with systemising gas governance goals that need further investigation at the Nigerian level but highlight similar emerging barriers. Although gas is critical to Nigeria's NDC as it contributes at least 40% of the goal, it is unclear how it intends to meet this goal. This insight means that we need to unpack Nigeria's gas governance goals to decide their feasibility and assess them for coherence.

Furthermore, the systemisation of global instruments led to four emerging barriers and a preference for standalone market and knowledge instruments over normative ones, with potentially little to no financing. It seems the global initiatives leave normative governance to the national levels when they could lead to setting global standards. As such, there may be ineffective knowledge, market and normative instruments. The systemisation also unearthed emerging barriers for Nigeria's associated gas flare governance instruments. It seems the 60-year institutional evolution of associated gas flare governance may not have created relevant instruments.

In addition, the systemisation of the global processes as either independent, partnership or hybrid processes seemed essential to understanding associated gas flare governance implementation, but there are five emerging barriers. It is, therefore, possible that the processes are not efficiently coordinated and collaborative. The systemisation also surfaced a fragmented view of the Nigerian associated gas flare governance process. It seems there are fragmented processes that could be better connected. These emerging barriers are outlined in the three parts of goal coherence, effective instruments and efficient processes in **sections 4.5.1** to **4.5.3**

4.5.1   Emerging barriers for goal coherence

Goal coherence is the intelligent coordination, steady communication and shared sense of direction in tackling flaring through increased use of gas and other governance goals. Within the constraints of this definition, I highlight two emerging barriers to goal coherence for the systematised associated gas flare governance.

#1 Lack of proportionality and specificity

Table 4-7 displays the two-part problem of tackling flaring, which applies to the global level. What stands out from the table is that while the priority goals of the initiatives are GHG related, a lack of proportionality and specificity in tackling flaring of associated gas is an emerging barrier to goal coherence.

Table 4-7 Lack of proportionality and specificity in associated gas flare governance goals

		Priority goals	GHG reduction target	
			End flaring	*Gas use*
Global initiatives	GGFR	Advocate flare-out policies & reduce associated gas flaring globally through projects.	But challenged by overlapping goals and lack of implementation	
	AM0009	Increase carbon credits demand and supply, supply consistent standards in gas commercialisation	But severly limited in its use due to the transition from Kyoto to Paris. It was last used in 2015	
	GMI	Increase methane use as a viable clean energy source and increase technical and financing partnerships	But only broadly focused on methane and open to discursive switching	
	OGCI	Support Zero Routine flaring, ensure accurate classification of flaring and influence governments on methane use	But seems to have no direct focus on ending associated gas flaring instead focused on methane	
	ZRF 2030	Get companies and governments to publish flare out data and end all global routine flaring by 2030	But could just be a rallying cry and virtue signalling	
Legend				
		Goal exist but challenged in terms of its specificity		
		Goal may exist but too broad and severely challenged		

Source: *Author, based on initiatives' documents*

The analysis of the priority goals of the initiatives against how they would reduce GHG from associated gas flaring and secure increased gas use shows a lack of proportionality. Proportionality here is the number of global climate initiatives interested in governing the two-part problem of ending flaring.

I chose the unit of analysis from the climate initiatives platform. I used the two aspects of the problem and a global focus as my inclusion/exclusion criterion. However, of the 259 initiatives registered on the platform, only four (<2%) were interested in global associated gas flaring governance, as defined in my thesis. Besides, the fifth, CDM AM0009, was chosen from outside the UNEP platform's database.

Notably, each of the five global initiatives have the ambition to reduce GHG and increase gas use. However, it was not clear how they would achieve this goal – specifically linked to ending of associated gas flaring, worsening the proportionality problem. For example, while GGFR and ZRF 2030 seem to directly tackle both aspects of the problem, there may be overlapping goals. The Global Methane Initiative (**GMI**) has a broad focus on methane and suffered a deregulation squeeze during America's Trump Presidency. The Oil and Gas Climate Initiative (**OGCI**) supports ZRF and wants a better classification of routine flaring. However, OGCI does not have any flare-out interventions.

While the UNFCCC CDM method number **AM0009** is critical for climate finance for ending associated gas flaring, its use has dwindled since 2015. AM0009 may be suffering in the transition from the Kyoto Protocol to the Paris Agreement[105] (**Figure 4-5**). Over 140 projects have been registered using one variant of the **AM** (large scale), **ACM** (consolidated), **AMS** (small scale) CDM methodologies since 2006. However, only 26 were for AM0009 "recovery and utilisation of gas that would have been flared or vented". Thus, while AM0009 had led to the reduction of over 14 $MtCO_2$ since 2006, it has only achieved 0.4 $MtCO_2$ since 2015.

	Total reduction since 2002	Total reduction up to 2015	Total reduction in Nigeria	Total reduction since 2015
■ Quantity reduced	14,231,198	13,798,782	4,668,609	432,416
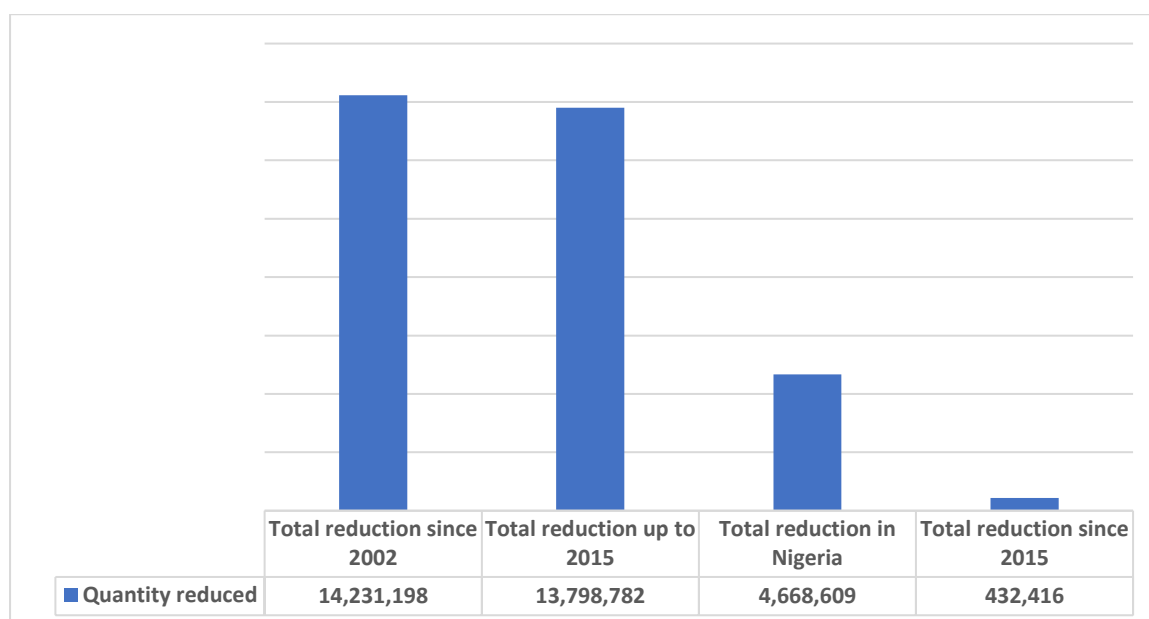
Figure 4-5 Total CO₂ reduction by AM0009 for flare-out projects between 2006 to 2015

Source: UNFCCC Projects[105]

---

[105] "CDM: Project Activities," UNFCCC.

#2 Interlinked conditional goals, but lack of gas-specific legislation

Table 4-8 shows the two-part interlinked emerging barrier for goal coherence at the Nigerian level. Nigeria's three gas governance goals are ambitious but heavily interlinked and interdependent. Nigeria has progressed from ignoring associated gas governance to one of an ambitious NDC linked to recovery and use of flared gas. However, there is heavy dependence on donor funding. Despite being critical for gas governance and close to two decades[106] of a start-stop, unhurried and uncoordinated process[107,] there is yet to be any gas-specific legislation[108].

There seems to be a recognition that a 40-year-old law (Petroleum Act 1969) does not cater for associated gas in a highly volatile market. But there seems to be no way forward due to unresolved differences in the President's role as the substantive Minister of Petroleum[109]. However, it is doubtful that international donors' funds could be used for flare-out projects[110]. Notably, the advocacy of global actors could help Nigeria secure more robust associated gas flare governance. For example, USAID, Power Africa and GGFR are international partners of the NGFCP[111].

---

[106] Julia Payne and Camillus Eboh, "Nigeria passes major oil reform bill after 17-year struggle," *Reuters*, 18 January 2018, https://www.reuters.com/article/us-nigeria-oil-law/nigeria-passes-major-oil-reform-bill-after-17-year-struggle-idUSKBN1F72I2?.

[107] NEITI Policy briefs, *"*The Urgency of a New Petroleum Sector Law," *NEITI Policy briefs* issue 2 (September 2016), https://neiti.gov.ng/index.php/2017-07-27-13-55-55/policy-brief.

[108]NEITI Policy briefs, "The Urgency of a New Petroleum Sector Law."

[109] Carsen, 2018.

[110] "Donors must do more to align development finance with climate goals – OECD 2018," OECD, accessed 10 May 2021, https://www.oecd.org/newsroom/donors-must-do-more-to-align-development-finance-with-climate-goals.htm. See also, "PM announces the UK will end support for fossil fuel sector overseas - GOV.UK 2020," UK Government, accessed 10 May 2021, https://www.gov.uk/government/news/pm-announces-the-uk-will-end-support-for-fossil-fuel-sector-overseas.

[111] "Home | Nigerian Gas Flare Commercialization Programme."

Table 4-8 Emerging barriers for Nigeria's associated gas flare governance goals

		Priority goals	GHG reduction target	
			End flaring	*Gas use*
Nigerian initiative	NDC goal	Deliver 40% of the 405 MtCO2 from gas:63 MtCO2 from ending flaring by 2030 and 102 MtCO2 from efficient gas generators.	But all three goals are severally challenged and heavily dependent on conditional climate finance and lack of gas-specific legislation and other emerging barriers	
	Associated gas flare commercialisation goal	To create sustainable value and wealth, implement the gas policy & kickstart a gas-based industrialisation with $500 million carbon credit		
	Gas based industrialisation	To create gas-based industrialisation, stimulate and fulfil local demand and secure presence in international markets		
Legend				
		Goal exist but challenged in terms of its specificity		
		Goal may exist but too broad and severely challenged		

Source: *Multiple Nigerian gas governance documents*

4.5.2   Emerging barriers for effective instruments

Effective instruments are a combination of knowledge and market mechanisms as enablers of normative instruments and require the design and application of each to govern gas effectively. To that end, I highlight four emerging barriers to effective instruments that appeared from the systemisation of associated gas flare governance.

#3 Lack of published information

Nigeria has celebrated gas-based industrialisation as a "big win" and referred to 2020 as "the year of gas"[112]. However, a lack of published information to assess the validity of these claims and Nigeria's associated gas flare governance goals is an emerging barrier. Despite extensive plans to collaborate and a road map in the Gas Policy of 2017[113], there were no publicly trackable data as of December 2020. As a member of ZRF2030, Nigeria could have publicly tracked its flare-out progress, but this is not happening[114]. The gas-based industrialisation assumption of stimulating local demand and

---

[112] Federal Republic of Nigeria, National *Gas Policy,* p. 11.

[113] Federal Republic of Nigeria, National *Gas Policy*, pp. 91-98.

[114] "Reporting. Zero Routine Flaring by 2030," World Bank, accessed on 10 May 2021, https://www.worldbank.org/en/programs/zero-routine-flaring-by-2030#5.

achieving international market presence requires transparency and accountability. Nigeria's gas commercialisation success depends on accurate data, integrity, and dealing with the emerging barriers. Although the 2018 Flare Regulation stipulates reporting, this is on a voluntary self-reporting basis with data supplied to DPR, which may not have the capability to verify these data. In addition, the number of flare sites has reduced from 90 to 70 to 40 since the programme started[115], intensifying the lack of investor trust.

#4 Lack of fundamentals in the Nigerian 2017 gas policy

Although adopting international best practices was claimed in the 2017 gas policy, its assessment against the fundamentals of policymaking[116] shows a three-part emerging barrier (**Table 4-9**).

Table 4-9 Lack of fundamentals of the Nigerian 2017 gas policy

Theme	Results	RAG
A. Policy design	**Clarity**: Clear but focused on energy not environment	Fair
	Evidence: Mixed against the adoption of the Norwegian model.	Fair
	Feasibility: Low chance of success due to persistent challenges	Weak
B. Legitimacy	**Investor confidence**: Significant distrust in government organisations	Weak
	Stakeholder engagement: multi-stakeholder and open engagement	Not rated
	Political commitment: Important political actors are opposed.	Weak
C. Action	**Management**: Significant weaknesses in roles and mechanisms.	Weak
	Monitoring: No publicly available and trackable data.	Weak
	Alignment: Different interest & important local actors are not cooperating.	Fair
Legend		
Weak rating		
Fair rating		
Good/strong rating		
Not rated due to lack of data, but covered in chapter 5 and 6 under systems thinking		

Source: *Author*

---

[115] NGFCP, *Frequently Asked Questions. Nigerian Gas Flare Commercialisation Programme*.

[116] Centre for Public Impact, *The Public Impact Fundamentals Report* (CPI, 2016), https://www.centreforpublicimpact.org/assets/documents/CPI-Public-Impact-Fundamentals-Report-English.pdf.

Policy design

While the 2017 gas policy is clear on energy outcomes, there are gaps in climate change and environmental outcomes. For example, there is a lack of clarity on how Nigeria could meet its 40% NDC target linked to gas (**section 4.4.1**).

Strengthening climate goals is needed as they are too abstract in the current provisions[117]. Although the policy mentions the environment repeatedly, there are no clear, measurable outcomes. There are only references to how the gas regulators plan to collaborate with the MoE. Furthermore, as far back as 2006, developing countries were warned of the challenges of inadequate capabilities and adopting the full-scale Norwegian model[118]. However, the 2017 policy adopted (in design) the full-scale Norwegian model and separating functions while acknowledging a significant lack of capability[119].

Legitimacy

Low investor confidence, mixed political support and a lack of primary legislation are real challenges for the policy's sustainability. Investor trust is low due to a lack of clarity in ownership structures and licences[120], and NNPC's performance and alleged corruption[121]. Indeed, political interest and extreme competition in Nigeria tend to neuter critical interventions[122]. This trend of distrust and low investor confidence may continue due to the unresolved tensions between Executives and Legislators about the Petroleum Industry Bill.

Action

---

[117] Federal Republic of Nigeria, *National Gas Policy*, pp. 32-34, 50 & 60

[118] Farouk Al Kasim, *The Relevance of the Norwegian Model to Developing Countries* (World Bank, 2006).

[119] Federal Republic of Nigeria, *National Gas Policy*, pp. 83-87

[120] NEITI Policy briefs, "The need to know who owns what in Nigerian extractive sector," *NEITI Policy briefs* issue 1 (May 2016), https://neiti.gov.ng/index.php/2017-07-27-13-55-55/policy-brief.

[121] Marc-Antoine Pérouse de Montclos, "The politics and crisis of the Petroleum Industry Bill in Nigeria," *The Journal of Modern African Studies* 52(3): p. 410-411. https://doi.org/10.1017/S0022278X1400024X.

[122] Thurber et al., p.5377.

A lack of management and MRV capabilities coupled with a lack of alignment at the country level contributes to the emerging barriers. Management capability is a crucial challenge, and the 2017 policy dedicated multiple sections to building capability; however, there are critical gaps[123]. For example, while the policy covers metering and measurement, there are gaps in tracking progress[124] . As of October 2020, an online search showed no evidence of monitoring progress. Besides, as already mentioned, the tension between Executives and Legislators shows country-level misalignment.

However, the alignment of the 2017 policy with the interest of the World Bank's GGFR and other global actors may lead to successful implementation. This alignment has already led to technical support for commercialisation programme implementation by USAID, Power Africa and GGFR[125].

#5 Lack of infrastructures and commercial frameworks

Decades of neglecting gas resources mean a lack of infrastructure investments, leading to challenges in implementing effective commercial frameworks. Examples include dedicated gas extraction wells, storage, gas distribution pipelines, Liquified Natural Gas Terminals, and local and international distribution pipelines. The 2017 gas policy acknowledged that these were needed but absent and promised to map critical infrastructures and supply recommendations[126].

Nigeria has carried over the challenges in lack of infrastructure for decades. However, in the meantime, the success of Nigeria's commercialisation programme depends on attracting investors to rely on ageing infrastructures, old blueprints and a lack of gas-specific legislation. These barriers stifle the commercialisation programme, meaning its chances of success are limited. The low success of the commercialisation programme also means little chance for Nigeria to meet its NDC goal. However, a lack of infrastructures potentially has more deep-rooted origins linked to investor trust – I trace the lack of commercial frameworks in **section 5.4.2.4** of Error! Reference source not found..

#6 Standalone instruments, lack of norms and finance

---

[123] Federal Republic of Nigeria, *National Gas Policy,* pp. 35-48, 50-54, 65-68 and 83-87.

[124] Federal Republic of Nigeria, *National Gas Policy* p. 38.

[125] "Home | Nigerian Gas Flare Commercialization Programme."

[126] Federal Republic of Nigeria, *National Gas Policy,* pp. 65-82.

There seems to be a disconnect between the knowledge, market and normative instruments with emerging barriers at both the global and Nigerian levels. While the global units of study use knowledge and market instruments, they seem to do so on a standalone basis. Besides, they do not seem to combine knowledge and market instruments with setting standards. Such a combination could lead to consistencies in knowledge instruments and secure effective use of markets while creating norms for usage at the national levels. This emerging barrier is crucial because it exists in the space of weak knowledge management, as highlighted in the eighth emerging barrier (**section 4.5.3**).

Nigeria's associated gas flare governance instruments result from a 60-year institutional evolution, which led to potential financing barriers, among others. For example, there is a lack of finance to meet Nigeria's conditional NDC targets. According to the World Bank, Nigeria needs more than $142 billion to deliver its NDC targets, with economic benefits estimated at $304 billion[127].

While the Green Climate Fund, World Bank, IFC and AfDB are potential sources[128]', further work is needed to raise financing. Furthermore, there is a need for additional work due to divestments from fossil fuels by international donors. However, what seems to be missing is how Nigeria and the international community plan to raise the needed investments. Notably, the gas commercialisation programme claims could generate up to $800 million annually from flared gas[129]. Therefore, Nigeria could generate internal investment. However, low investor trust and the validity of the rights to seize and auction the flared gas are limiting factors.

---

[127] World Bank, *Low-Carbon Development for Nigeria* (Washington, DC: World Bank): pp. 138-140 https://doi.org/10.1596/978-0-8213-9925-5.

[128] Federal Republic of Nigeria, *Approved Nigeria's INDC* (UNFCCC/Nigerian Ministry of Environment 2015): pp. 3-4 , https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Nigeria%20First/Approved%20Nigeria%27s%20INDC_271115.pdf.

[129] NGFCP" News-Events: FG to save $800m as it seeks investors to commercialise flare gas," *NGFCP,* 2018. https://ngfcp.dpr.gov.ng/news-and-events/posts/2018/april/fg-to-save-800m-as-it-seeks-investors-to-commercialise-flare-gas/.

4.5.3   Emerging barriers for efficient processes

Efficient processes go beyond independent or partnership working. From the analysis, efficient processes include knowing whom to work with, enabling a collaborative environment, and the capability to collaborate. To this end, I carve a new path for assessing and gauging process barriers.

#7 Duplication of activities

As captured in **Table 4-10,** the results show that knowledge management is essential at the global level (it is also critical at the Nigerian level). However, duplication of activities may be leading to inconsistent messaging. For example, knowledge management is embedded in "dissemination technical knowledge and facilitating an exchange with relevant stakeholders"[130]. Besides, the use of GGFR's best practice policy guidance could be for (1) raising awareness, (2) for policy planning and recommendation and (3) advocacy activities, which are the knowledge dissemination activities[131]. Furthermore, AM0009 supplies a knowledge platform to make the carbon markets more accessible[132]. However, they all seem to be covering the same ground and could be sending contradictory messages.

Table 4-10 Potential duplications of activities by global associated gas flare governance initiatives

| | | | Global initiatives | | | | |
		Activities	GGFR	AM0009	GMI	OGCI	ZRF
Functions	Political dialogue	1.Advocacy	🟩	🟩	🟩	🟩	🟩
		2. Awareness raising and outreach	🟩	🟩	🟩	🟩	🟩
		3. Policy planning and recommendation	🟩	🟩	🟩	🟩	🟩
	Technical dialogue	4. Norms and standards setting	🟥	🟩	🟥	🟥	🟥
		5. Knowledge production and innovation	🟩	🟩	🟩	🟩	🟩
		6. Knowledge dissemination and exchange	🟩	🟩	🟩	🟩	🟩
	Implementation	7. Technical implementation (ex-post)	🟩	🟩	🟩	🟥	🟥
		8. Goal setting (ex-ante)	🟥	🟥	🟥	🟩	🟩
	Capability building	9. Training of individuals and organisations	🟩	🟩	🟩	🟥	🟩
	Funding	10. Fundraising	🟩	🟩	🟩	🟩	🟥

---

[130] Jørgen Villy Fenhann et al., *The Climate Initiatives Platform: Towards Greater Transparency in International Cooperative Climate Initiatives (ICIs)* (Denmark: Nordic Council of Ministers, 2018): pp. 15 23, and 47, https://unepdtu.org/publications/the-climate-initiatives-platform-towards-greater-transparency-in-international-cooperative-climate-initiatives-icis/.

[131] GGFR, *Guidance on upstream flaring and venting.*

[132] "CDM: Recovery and utilization of gas from oil fields."

		11. Financing						

	Legend
	The initiative engages in the activity and there is duplication
	The initiative does not engage in the activity

Source: *Author, based on documents of the initiatives*

#8 Weak deployment of Knowledge management processes

As outlined in **Table 4-11,** there is a weak knowledge management process at the global level. There are four processes of progressive development in knowledge management: creation, external acquisition, storage and sharing[133]. However, the analysis of its application at the global level shows a failure to engage in the fourth process effectively: sharing knowledge cross-initiatives.

The five initiatives make efforts to create internal knowledge supported by acquiring external knowledge from partners. For example, GGFR has a resources page[134], ZRF 2030 covers reporting[135] and GMI works with country partners[136]. However, while they store knowledge in documents and have routines and processes to achieve their goals, the five initiatives may have failed to share knowledge effectively.

---

[133] Pamela Chasek et al., "Integrated land degradation monitoring and assessment: Horizontal knowledge management at the national and international levels," *Land Degradation & Development* 22(2) 2011, pp. 272-284. https://doi.org/10.1002/ldr.1096.

[134] "Global Gas Flaring Reduction Partnership (GGFR)." World Bank accessed 10 May 2021, https://www.worldbank.org/en/programs/gasflaringreduction#5.

[135] "Zero Routine Flaring by 2030," World Bank, accessed 10 May 2021, https://www.worldbank.org/en/programs/zero-routine-flaring-by-2030#5.

[136] "Partner Countries | Global Methane Initiative," GMI, accessed 10 May 2021, https://www.globalmethane.org/(X(1)S(nujr3lxmddr2udfplqxtxduq))/partners/index.aspx.

Table 4-11 The application of knowledge management in global associated gas flare governance

			Global Initiatives				
			GGFR	AM0009	GMI	OGCI	ZRF
Knowledge management processes		1. Creating internal knowledge	At least 23 knowledge products or documents	Methods and accreditation	"How to" and action plans	Reports and innovations technologies	Annual country and company flare-out progress report
		2. Acquisition of external knowledge	From best-in-class countries for policy guidance	From DNA, DOE, technical panels, and stakeholders.	From technical and financing partners and countries	Through innovation partners R&D	NOAA and other experts
	3. Storing knowledge	3.1 in documents	Reports and guidance	Reports and guidance	Annual Reports and guidance	Annual report and whitepapers	Annual report and whitepapers
		3.2 In routines processes	Best practices	Rules, methods and baselines	Action plan and "how-to"	Innovation and investment challenge	Questions and Answers
		3.3 In a database	None publicly searchable	AM0009 projects	Projects and action plans.	None publicly searchable	None publicly searchable
	4. Sharing knowledge	4.1 Within initiatives	Simple and complex knowledge mechanisms shared with initiatives and their immediate members				
		4.2 Across initiatives	Flaring data and technology	CDM standards	Partners technical expertise and financing	Satellite data project (GGFR)	Flaring data and technology
Legend							
🟥		Based on document analysis it seems there is no existing process					
🟧		Based on document analysis it is unclear if there is an existing process					
🟩		Based on document analysis the process exists					

Source: *Author, based on Chasek et al. (2011) and initiatives documents*

#9 Lack of capability

Table 4-12 shows the four potential ways of adopting the Norwegian model and Nigeria's positioning based on (a) political dynamics and (b) capability. Although a high political dynamic positions Nigeria on quadrant **IV** or **II**, capability places it on quadrant **I** or **II.** Nigeria's positioning potentially shows an ambition that may not match its capability. Separate functions could reduce conflicts of interest and supply clarity[137]; however, Nigeria may have ignored essential warnings about adopting the

---

[137] Federal Republic of Nigeria, *National Gas Policy*, pp. 30-40,

Norwegian model[138]. These warnings include tailoring the adopted version to the country's capability and an incremental approach.

Table 4-12 Norwegian model options and Nigeria's positioning

		Political Dynamics	
		Low political competition	*High political competition*
Institutions of Governance	*High capability*	**Quadrant III** **Suggest**: combined functions **Examples**: Malaysia (under Mahathir)	Quadrant IV Suggest: Separate functions Examples: Norway, Brazil, UK, and Mexico Where Nigeria has positioned itself
	Low capability	**Quadrant I** **Suggest**: Combining functions **Examples**: Angola	**Quadrant II** Suggest: Develop capability, before progressing to Quadrant IV **Examples**: Nigeria Where Nigeria should be

Source: *Modified from Al-Kasim (2006); Thurber et al. (2011)*

For a country with a low level of capability like Nigeria, a combination of functions is more practical. The functions can initially be combined, progressing to separation as politics become more pluralistic, as was the case in Malaysia[139]. This adoption of models that do not fit is a reoccurring problem with developing countries. They try to adopt full scale without proper modifications, policies, frameworks, or economic and governance solutions from developed countries, leading to more problems.

Given the intensity of political competition in Nigeria, it is either quadrant II or IV. This positioning means its options are either initially leaving the functions combined and developing relevant capabilities first or separating functions.

Nigeria chose the latter as its means of realising its goal of increased gas use and ending flaring. Furthermore, I supported my suspicion of the gap between Nigeria's ambition and capability with the

---

[138] Thurber et al., 2011. But see Al Kasim, 2006.

[139] Thurber et al., 2011.

World Bank Worldwide Governance Indicators[140] in **Table 4-13** below. It shows that Nigeria may not have the capabilities of Norway to implement the model. My readers should note that even if Nigeria's performance is increased to account for the" usual negative ratings of global indicators for developing countries" the performance still does not show the required capability to adopt the full-scale Norwegian model. However, my readers should also note such a decision is a sovereign one.

Table 4-13 Norway Versus Nigeria: Governance indicators score (%) – 2008 to 2017

Governance indicators	Year of assessment and score									
	2008	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*
1.A Norway's corruption controls	95	95	97	98	99	99	99	99	99	100
1.B Nigeria's corruption controls	19	16	15	11	11	9	8	13	13	13
2.A Norway government's effectiveness	97	97	98	97	98	98	98	98	97	97
2.B Nigeria government's effectiveness	17	9	11	13	17	17	12	16	12	16
3.A Norway's political stability	96	93	95	97	95	96	90	91	93	90
3.B Nigeria's political stability	5	4	3	3	3	4	5	6	6	5
4.A Norway's quality of regulation	89	93	93	94	93	95	93	92	93	96
4.A Nigeria's quality of regulation	21	25	26	27	26	27	24	22	18	17
5.A Norway's rule of law	100	98	99	98	100	99	99	99	100	100
5.B Nigeria's rule of law	15	12	12	13	10	12	13	16	15	19
6.A Norway's voice and accountability	100	99	100	100	100	100	100	100	100	100
6.B Nigeria's voice and accountability	27	25	28	27	27	28	30	35	35	35
Legend										
🟥	Scored < 25% from a potential 100%									
🟧	Scored > 25% but < 50% from a potential 100%									
🟩	Scored > 50% from a potential 100%									

Source: *World Bank Worldwide Governance Indicator*

#10 Lack of systems thinking

Table 4-14 captures the **DCC's** request for support to enhance its NDC[141], which lacks system thinking for two reasons. First, despite being critical to Nigeria's decarbonisation and economic growth plans, only 15% of partners support the oil and gas theme and only 6% for the power-to-industry and power-to-housing. Second, the above shows a potential lack of systems thinking by the international partners. Either they missed the multiplier effect that power-to-industry and housing has, or the DCC has not been able to tell a convincing story of both.

---

[140] World Bank, *WGI-Interactive Data Access,* https://info.worldbank.org/governance/wgi/Home/Reports.

[141] NDC Partnership, *Nigeria – Overview*, https://ndcpartnership.org/countries-map/country?iso=NGA.

The finding shows low "% active interventions" compared to "total % of partners involved" in four critical areas. For example, only 6% of potential partners are actively involved in Policy and Legal Framework Strengthening, which could improve Nigeria's weak normative instruments (section 4.4.2). Furthermore, only 10% are actively involved in Budgeting, Planning and Climate Change Financing. This finding shows low involvement in financing, although Nigeria needs at least $142 billion in climate financing[142].

Moreover, only 8% are actively involved in Institutional Capacity Strengthening, which could improve knowledge instruments. They were shown to be potentially weak in **section 4.4.2**. In addition, only 7% are actively engaged in *Carbon Markets and Article 6 capability building*.

Nigeria's NDC is highly dependent on gas. However, there is a potential divestment from fossil fuels by international donors and weak market instruments. Moreover, the active support for oil and gas, power industry and housing are low. These are the critical areas with multiplicative effects that would reduce Nigeria's future emission potentials. The results show that there may be a divergence between international partners' goals, the support they offer and what Nigeria needs. These differences often manifest in unrealistic climate action commitments and lengthy negotiation processes to make them realistic.

The support for oil and gas covers five areas which include:

- **F.1** Fugitive methane pilot study.
- **F.2** Development of NNPC climate change strategy (including climate finance strategy, climate finance options, commercialisation of GHG reductions).
- **F.3** Development of climate finance proposals (gas flaring regulations, fugitive methane).
- **F.4** Framework for quantifying: gas flaring, fugitive methane emissions and assessment of emissions from refineries.
- **F.5** Development and improvement of GHG inventory, baselines and MRV Procedures.

---

[142] World Bank, Low-*Carbon Development for Nigeria* (Washington, DC: World Bank, 2013): pp. 138-140, https://doi.org/10.1596/978-0-8213-9925-5.

Table 4-14 Support to enhance Nigeria's NDC and potential lack of systems thinking

		Total % of global partners supporting	% Of global partners actively supporting	% Of global partners planning to support	% Potential support from global partners
Area of support	A. Policy and Legal framework strengthening	35	6	17	13
	B. Institutional Capacity Strengthening	36	8	17	11
	C. Budgeting, Planning and Climate Financing	40	10	10	20
	D. Carbon Markets and Article 6 and NDCs	40	7	10	22
	E. Energy	25	17	6	3
	F. Oil and Gas	15	3	7	5
	G. Agriculture	31	11	1	18
	H. Power - Industry	6	4	0	6
	I Power - Housing	6	4	0	2
	J. Transport	7	2	2	3
	K. Water	17	0	0	17
	L. Waste	27	2	18	7
Legend					
	10% or < of the 12 partners/donors support				
	> 10% but < 25 of the 12 partners/donors support				
	25 or > of the 12 partners/donors support				

Source: NDC Partnerships[141]

#11 Fragmented gas governance process in Nigeria

While the 10 preceding emerging barriers might contribute to inefficient processes in Nigeria's gas governance, a key factor is a fragmented process. Despite the challenges in lack of capability, **Figure 4-4** showed the planned gas governance process. However, there seems to be no similar framework for climate action or one that integrates both aspects. Without clearly integrated gas governance and climate action processes, it is not surprising that there has been a shifting timeline of Nigeria's gas commercialisation.

Besides, while the 2017 gas policy refers to planned collaboration, only a small section of the policy has been dedicated to coordination with the climate change governance organisations. The word "environmental" was mentioned 11 times in the 2017 gas policy (56 times if expanded to include "environment"). There is only a promise to adopt best practices, which by itself could be modified to reflect the national contextual realities.

There is an expectation of an inter-ministerial working group involving eight government agencies/departments to deliver the commercialisation programme. However, although the programme was launched in December 2016, as of November 2020, there has been no final choice of

successful bidders. As a result, the bid submissions deadline was extended to June 2020[143]. The shifting timelines[144] directly affect the ability to attract third-party investors and cast doubts on the assumption of inter-ministerial working. However, Nigerian government agencies may have a higher level of collaboration than the document evidence currently shows. As such, this is a crucial aspect of my triangulation through my semi-structured elite interviews.

4.5.4   Viability of global and Nigerian associated gas flare governance – after charting emerging barriers

Research objective three: (b) to assess the viability of the systematised global and Nigerian associated gas flare governance after charting the emerging barriers: There may be a potential for a single connected system, but there are gaps between the global and Nigerian systems due to the 11 emerging barriers captured in **Table 4-6**.

As shown in **Figure 4-6**Error! Reference source not found.**,** these mean that we currently have a two-part unconnected system. The 11 emergent barriers constrained the system from reaching minimum viability. This was acceptable to me as a novice researcher, and this could be the reality. Besides, I had conducted the first systematisation attempt using document sources and my own insights.

While some of the emerging barriers at the Nigerian level were stark, they were not far off those that existed at the global level and a lack of systems thinking was a common emerging barrier. While politics of hydrocarbon was an origin of the significant barriers at the Nigerian level, this also happens elsewhere; for example, in the levelling up agenda which is part of the UK politics as of 2019. Besides, the politics of sponsors was an origin to significant barriers at the global level. In Nigeria the primacy of oil revenue is an important problem. We have this problem because the government wants to earn more oil to export to earn rent – money and this has always been the prime concern – maintaining an exportable surplus of oil to earn revenue.

---

[143] "Notice of revised Bid Submission Due Date | Nigerian Gas Flare Commercialization Programme," NGFCP 2020, https://ngfcp.dpr.gov.ng/notice-to-bidders/notice-of-revised-bid-submision-due-date/.

[144] NGFCP, "The Journey So Far & Next Critical Steps."

The results were interesting for a couple of reasons. At the global level, five of the emerging barriers manifested into eight real barriers and I was able to trace their root origins and map their influences covering the three aspects of governance: goals, instruments and processes. At the Nigerian level, eight of the 11 emerging barriers manifested into 10 actual barriers and again, I traced their root origins and influences like the global level.

A lack of systems thinking was an emerging barrier at both abstraction levels but became a root origin: A lack of systems thinking was critical and shows fundamental challenges in the system. For example, BEIS has funded the Nigerian Department for Climate Change to create a Monitoring Reporting and Verification (MRV) system while the Nigerian Department for Petroleum Resources is investing to create similar system (NDC Partnership, 2021). This shows at least a waste of taxpayer funds or could lead to multiple systems that could not communicate with each other.

For example, global actors like International Climate Finance/BEIS (who were not in the original actors list) could insist that as a condition of its financing an MRV for the DCC in Nigeria, the environmental coordinators work more closely with the industry regulators – which will start to tackle the root origin of lack of systems thinking across both level but also tackle barriers such as lack of accurate data and fragmented MRV process and lack of regulatory clarity and cross-cutting regulation. Transparency initiatives such as NEITI and FOSTER could help facilitate such a solution. This solution does not require creating primary legislation to make it work.

Global associated gas flare governance goals

Lack of intelligent coordination

Lack of steady communication

Lack of mutual sense of direction

Global associated gas flare governance instruments

Lack of effective knowledge instruments

Lack of effective market instruments

Lack of effective normative instruments

(in)coherent goals

(in)effective instruments

Global associated gas flare governance system

(in)efficient processes

Global associated gas flare governance processes

Not knowing who to collaborate with

Lack of enabling environment and willingness to collaborate

Lack of capability to collaborate

Nigerian associated gas flare governance goals

Lack of intelligent coordination

Lack of steady communication

Lack of mutual sense of direction

Nigerian associated gas flare governance instruments

Lack of effective knowledge instruments

Lack of effective market instruments

Lack of effective normative instruments

(in)coherent goals

(in)effective instruments

Nigerian associated gas flare governance system

(in)efficient processes

Nigerian associated gas flare governance processes

Not knowing who to collaborate with

Lack of enabling environment and willingness to collaborate

Lack of capability to collaborate

Figure 4-6 Two-part – global and Nigerian associated gas flare governance system

Source: *Author*

4.6   Summary of chapter four

This chapter has shown that while there is a potential to systematise global and Nigerian associated gas flare governance system, 11 emerging barriers make it a nonsensical system. However, the chapter tried to systematise the global and Nigerian gas governance as goals, instruments and processes. The chapter also surfaced eleven emerging barriers potentially constraining each part of the system individually and collectively.

In Error! Reference source not found., I trace the manifestation of the emerging barriers into actual/other barriers and their influences and origins. I also determine the significant barriers and root origins. This approach allows for further qualitative evaluative research, relying on decision-makers (interviewees') insights into the barriers to enable targeted policy solutions.

Chapter 5   Barriers for global and Nigerian associated gas flare governance

5.1   Introduction to chapter five

This chapter answers my second research question: what are the manifested barriers, origins for the systematised global and Nigerian gas flare governance?? I operationalised the question by using three descriptive and gauging objectives. To that end, I first connected the emerging barriers from **Chapter 4** to those manifested in **section 5.2**.

Sections 5.3 and **5.4** collectively meets my fourth research objective which is to trace manifested barriers and origins for the systematised (a) global and (b) Nigerian associated gas flare governance. **Sections 5.5.1** and **5.5.2** collectively meets my fifth research objective to determine the significant barriers and their root origins for the global and Nigerian associated gas flare governance. Then, I assessed the viability of the global and Nigerian; associated gas flare governance systems based on the manifested barriers and origins in **section 5.5.3** to meet my sixth research objective**. Section 5.6** is the summary of the chapter.

5.2   Connecting emerging to manifested barriers for both abstraction levels

The emerging barriers from **Chapter 4** are connected to the manifested barriers in this section to set the scene and answer the second research question.

5.2.1   Global   connections   of   barriers   for   better   associated   gas   flare governance

Figure 5-1 shows the connections between five of the emerging barriers to eight which manifested in three categories of goals, instruments, and processes for the global level.

A lack of proportionality and specificity is connected to manifested barriers #1 and #2, leading to a lack of goal coherence. Goal coherence involves intelligent coordination, steady communication, and a sense of mutual direction[1] in tackling associated gas flaring.

---

[1] Adil Najam, Mihaela Papa and Nadaa Taiyab, *Global Environmental Governance: A Reform Agenda* (Winnipeg, Manitoba: International Institute for Sustainable Development, 2006), p. 72.

111

Furthermore, the standalone nature of instruments is connected to manifested barriers #3, #4 and #5, leading to a lack of effective instruments. Effective instruments include knowledge and market as enablers and norms to secure goals[2].

Likewise, three process-related emerging barriers are connected to manifested barriers #6, #7 and #8, leading to a lack of efficient processes[3]. As highlighted in my logical creation of "associated gas flare governance processes", the efficient process involves knowing whom to collaborate with, the enabling environment and capability. Finally, a lack of systems thinking is the most prevalent barrier, affecting manifested barriers #6, #7 and #8, and #2 to #5, leading to inefficient processes and instruments. Due to its connections, I upgraded the lack of systems thinking from an emerging barrier to an origin.

[2] Sebastian Oberthür, "Interplay management: enhancing environmental policy integration among international institutions," *International Environmental Agreements: Politics, Law and Economics*. 9(4), 2009: pp.377-378, https://doi.org/10.1007/s10784-009-9109-7.

[3] Oberthür, 2009.
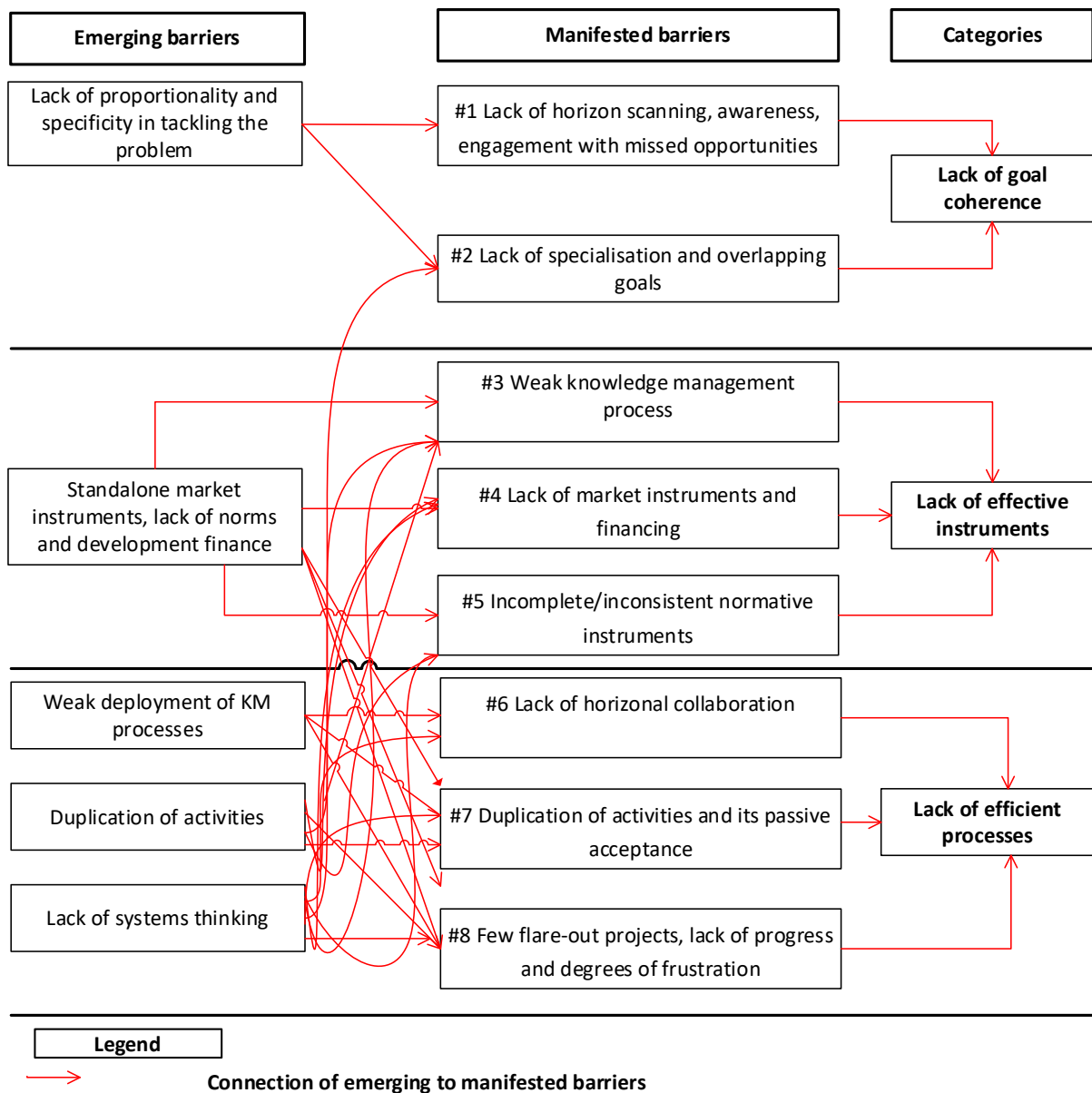
Figure 5-1 Connections between emerging to manifested barriers at the global level

Source: Author

5.2.2   Nigerian connections of barriers for associated gas flare governance

Figure 5-2 shows the connections between eight of the emerging barriers to 10 which manifested in three categories of goals, instruments, and processes for the Nigerian level. For example, the emerging barrier for goal coherence manifested into two barriers: lack of goal coherence and effective instruments. Likewise, a lack of infrastructure and commercial frameworks is manifested in both the lack of goal coherence and ineffective instruments (barriers #1 and #3). Furthermore, the lack of

fundamentals in the 2017 gas policy contributes to a lack of regulatory clarity (manifested barrier #9). In addition, three emerging process-related barriers manifest into three barriers that lead to a lack of efficient processes. Like the global level, the lack of systems thinking seems prevalent.
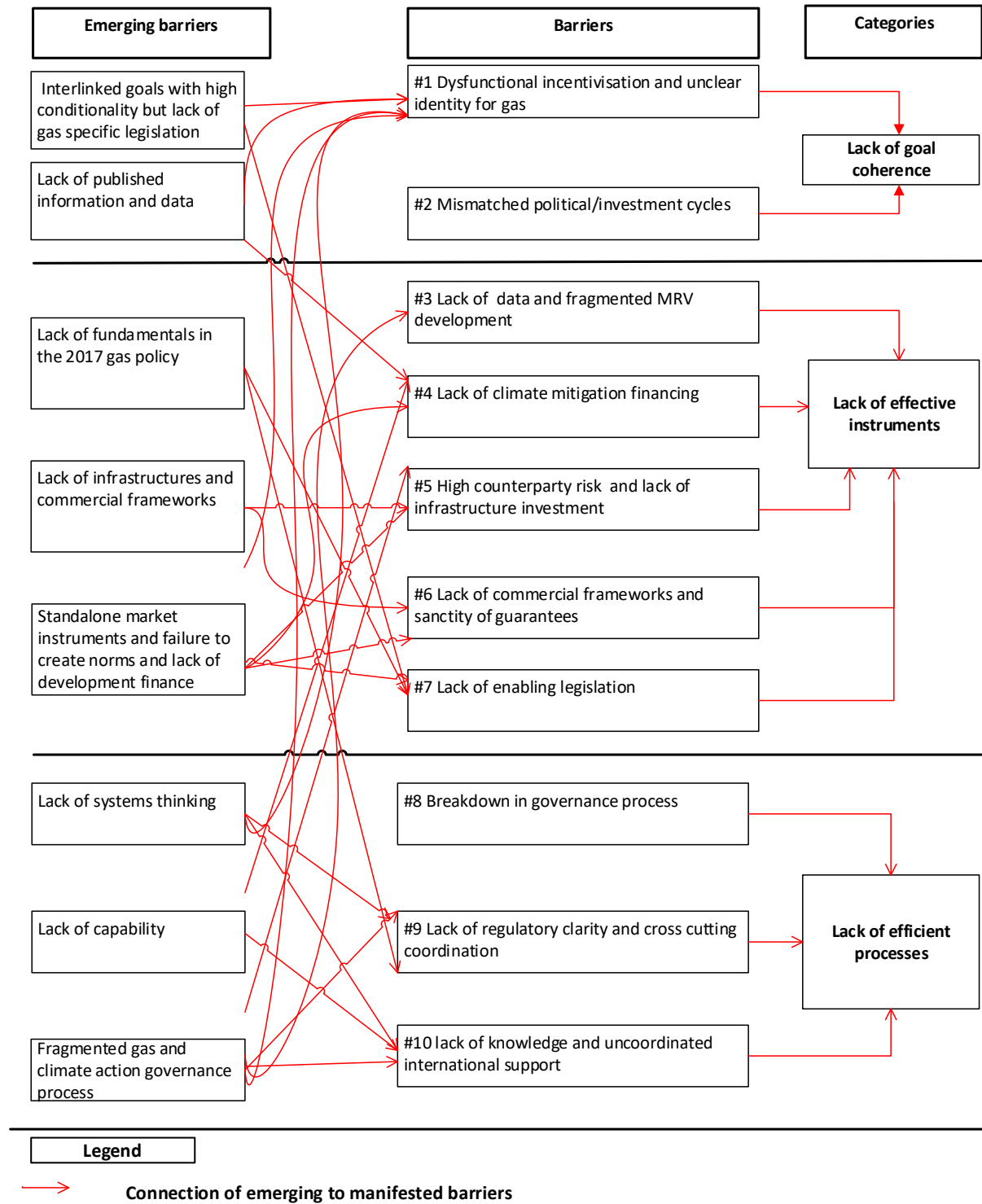
Figure 5-2 Connections between emerging to manifested barriers at the Nigerian level

Source: Author

5.3 Manifested barriers for global associated gas flare governance

Research objective 4: to trace manifested barriers and origins for the systematised (a) global associated gas flare governance: **Figure 5-3** visualises the messy interconnectivity between the manifested barriers, their origins and influences at the global level.

The relationships are not exhaustive. I could have connected them to the "Nth" degree. However, I stopped when I had enough network paths to establish a thick-enough pattern.

While the relationships are complex due to cross-category connections, they symbolise my description and gauged manifestation of barriers to the viability of the global associated gas flare governance system. For example, **Figure 5-3** models a total of 58 connections: four origins-to-origins, 11 origins-to-barriers, 17 barriers-to-barriers and 26 for barriers-to-influences.
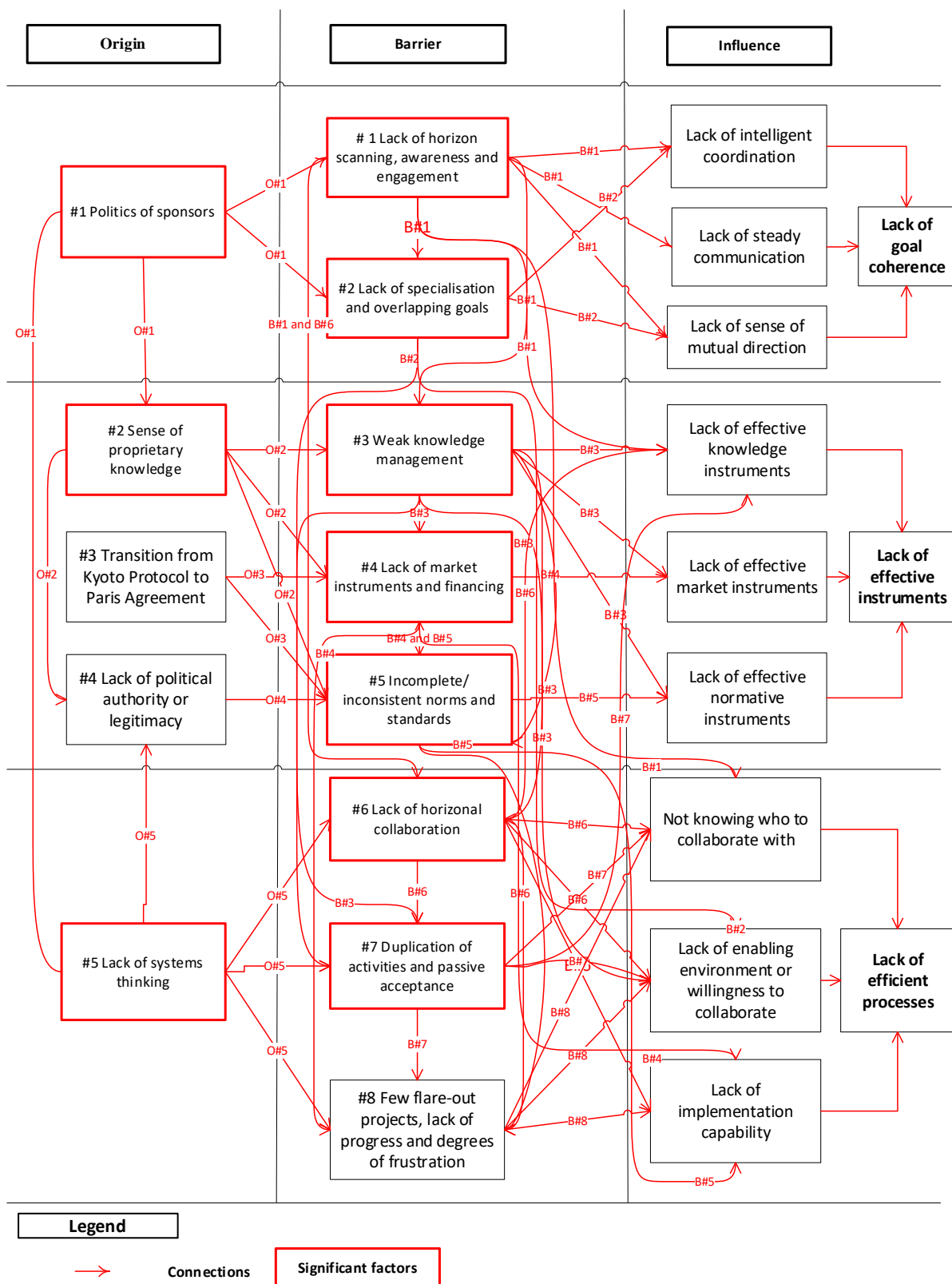
Figure 5-3 Visualisation of the connections between barriers at the global level

Source: Author

5.3.1   Barriers for goal coherence at the global level

As presented in **Figure 5-4**, the first main finding from the global level of analysis is that two barriers originate from the politics of sponsors with five connections to three influences. According to my interviewees, the politics of sponsors is a reoccurring problem in global associated gas flare governance, making it challenging to proactively engage with other actors (GINT4). However, it also limits the initiatives' ability to specialise, leading to overlapping goals (GINT1 and GINT2). It seems the politics of sponsors is a root origin which I explore further in **section 5.5.1.2**.

A lack of horizon scanning, awareness and engagement affects all three influences. However, a lack of specialisation and overlapping goals affects intelligent coordination and a sense of mutual direction. The origins and barriers influence a lack of goal coherence. The interrelated barriers show that the chances of having coherent goals at the global level are low. The barriers point to a lack of intelligent coordination, steady communication and mutual direction as influences.
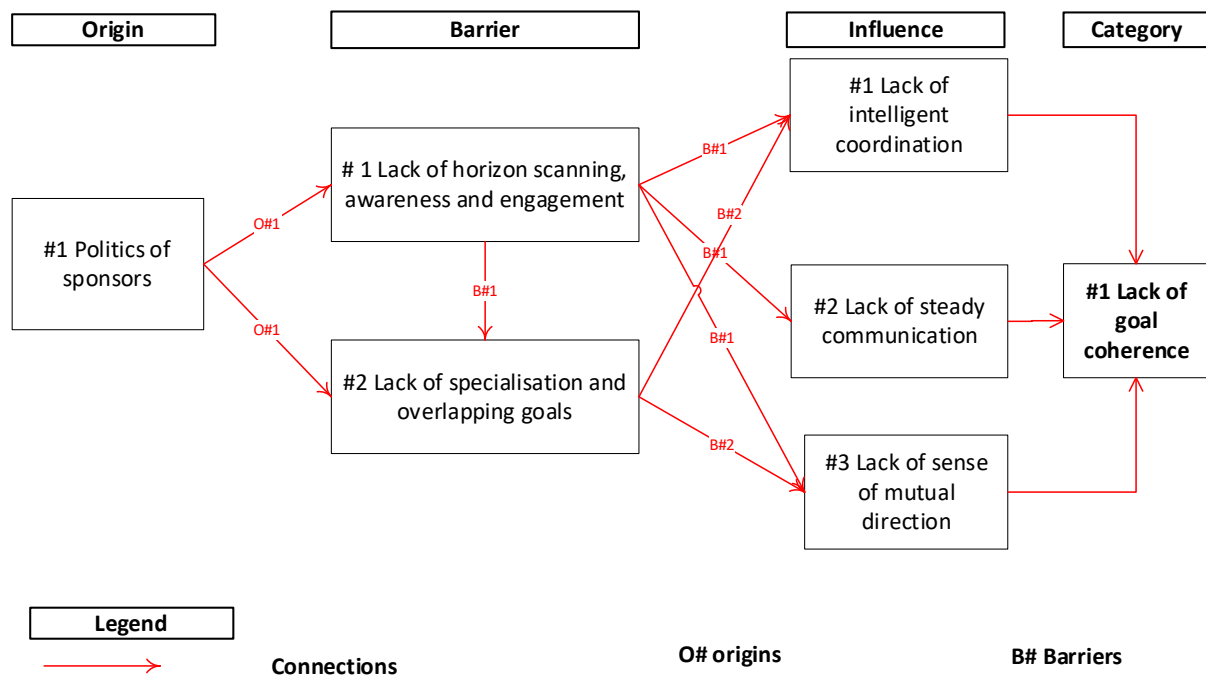
Figure 5-4 Barriers for lack of goal coherence at the global level

Source: Author

5.3.1.1 Barrier #1 Lack of horizon scanning, awareness, and engagement

An exploration of a lack of engagement with each other by the global initiatives led to two insights. It arises from a barrier of lack of horizon scanning by the initiatives, who could use their convening authority more effectively; but the origin is more interesting. According to an interviewee, AM0009 last met with GGFR in 2010 (GINT7). None of the other two AM0009 interviewees was aware of GGFR or ZRF. Furthermore, none of the GGFR and ZRF interviewees was aware of or engaged with AM0009 (GINT3 and GINT4). Therefore, the politics of sponsors is an origin to the barrier of lack of engagement by the global initiatives (GINT2).

Notably, there could be other underlying origins for the lack of horizon scanning and engagement. However, there seem to be lost opportunities for joint financing and implementing flare-out projects. For example, GMI claims to have raised over $600m and financed 1,100 methane-related projects[4]. In addition, AM0009 supports financing flare-out projects - it is the only CDM tool linking gas to carbon markets and GGFR claims to facilitate project implementation.

OGCI is the consortium of top oil companies with a $1billion war chest[5], and ZRF wants to end routine flaring by 2030. However, none of these initiatives seems to be working together to implement projects (GINT2). OGCI's $1 billion commitment may seem significant; however, it is $10 million per member per year on a straight-line basis. When contrasted with, for example, Royal Dutch Shell investment of $13 billion in 2018, $8 billion in 2017 and $30 billion million in 2016, the stark differences become apparent.

Indeed, one of my interviewees captured the view best – by saying: "they (the initiatives) do not seem to be horizon scanning or investing in solving the problem of flaring. Therefore, they cannot intelligently design impactful interventions as they do not know what the other initiatives are doing to tackle the same problem or investing" (GINT1). See **Table 5-1**.

---

[4] "Learn About the Global Methane Initiative | US EPA," US EPA, accessed 10 May 2021, https://www.epa.gov/gmi/learn-about-global-methane-initiative#t.

[5] "Our Investment Portfolio – OGCI," OGCI, accessed 10 May 2021, https://www.ogci.com/climate-investments/investment-portfolio/.

Table 5-1 Lack of awareness and engagement by the small number of initiatives

		Global Initiatives				
		GGFR	AM009	GMI	OGCI	ZRF
Global Interviewees	Code (GINT1-11) — GINT1*	Green	Green	Red	Red	Green
	GINT2*	Green	Red	Red	Orange	Green
	GINT3**	Blue	Red	Red	Green	Blue
	GINT4**	Blue	Red	Red	Green	Blue
	GINT5***	Green	Orange	Red	Blue	Green
	GINT6***	Orange	Red	Red	Blue	Red
	GINT7****	Orange	Blue	Orange	Red	Red
	GINT8****	Orange	Blue	Orange	Red	Red
Legend						
*Independent interviewee: not a staff of the five global associated gas flare governance initiatives						
**GGFR and ZRF interviewees						
***OGCI and ZRF interviewees						
****AM0009 interviewees						
Red	The interviewee is not aware of the initiative					
Orange	Interviewee is aware of the initiative but has had limited or no engagement with them					
Green	Interviewee is aware of the initiative and has engagement and has engagement with them					
Blue	The Interviewee's initiative					

Source: Author

5.3.1.2 Barrier #2 Lack of specialisation and overlapping goals

This barrier is also linked to emerging barriers #1 and #2 but manifested as a lack of specialisation and overlapping goals. In addition, there is a lack of specificity by the initiatives. For example, we could expect the OGCI with 13 top oil companies to have a specific associated gas flare reduction goal, but this was not the case, and one of their representatives said:

"We do not have any associated gas flare reduction specific goals, and we rely on GGFR and ZRF 2030 to tackle the quantity of associated gas flared" (GINT5).

In addition, AM0009 could directly tackle both areas of flare reduction and increased use of associated gas. However, an interviewee clarified that this was impossible under current circumstances:

"Its (AM0009) future as a carbon market instrument is uncertain post the full implementation of the Paris Agreement and when the NDCs have been fully negotiated" (GINT7).

My interviewees perceived varying levels of overlap and complementarity in their goals. However, there were more views of overlapping goals. For example, of eight interviewees, only one emphasised complementarity. Six emphasised overlapping goals and one a balanced view.

The main opposing view was that "there are no overlapping goals, among the five global initiatives that govern gas" (GINT5). However, another interviewee countered this opposing view by saying,

"There should be more specific global initiatives goals. As goals are the same, there is something wrong, and we should question it" (GINT6).

While the lack of specificity could be symptomatic of the politics of sponsors, each initiative should have a specific identity. According to one interviewee, the general goal could be the same - to reduce associated gas flaring and GHG from the gas sector (GINT6). However, each initiative could have its own specific identities, such as advocacy, financing or implementation. Another interviewee pointed out a gap that "while OGCI relied on GGFR and ZRF to tackle the problem, they only partially endorse ZRF goals which are specific to associated gas flaring" (GINT4).

Goals could overlap as sponsors want different things (GINT3). The reality is that the politics of sponsors means limited room for mergers. For example, reporting is the only difference between the GGFR and ZRF 2030; they both set goals, and there is no reason, why they should not be combined (GINT1). However, while GGFR and ZRF could have a strong symbiotic relationship with OGCI to achieve their specific goals, which is closer to the oil companies, this is not happening (GINT2 and GINT3).

5.3.2   Barriers for effective instruments at the global level

As presented in **Figure 5-5**, the second main finding of the global analysis is that three barriers connect to three origins with five linkages to the three influences meaning there are ineffective instruments.

First, a sense of proprietary knowledge is an origin. It affects the initiatives' ability to design and deploy effective instruments. For example, according to an interviewee, a sense of proprietary knowledge by GGFR and ZRF when dealing with private sector initiatives like OGCI means they do not share their knowledge (GINT4). Second, negotiations and uncertainties as part of the transition from the Kyoto Protocol to the Paris Agreement mean AM0009, which is the only gas governance market instrument, is ineffective.

Notably, there are other factors why climate change market instruments are usually ineffective: i.e., externalities and split incentives (risk and reward).

While my interviews have put forward the usual lack of political authority as a barrier to a normative instrument, I pragmatically challenge this view with targeted and sequenced policy solutions in section 6.2.4 in how they could practice knowledge management to secure political authority.

As a reminder, knowledge instruments reduce cognitive costs. In addition, market instruments encourage utilitarian decisions, and both are enablers of normative governance. In what follows, I show how the manifestation of the barriers and the nature of their origins mean there are ineffective instruments.
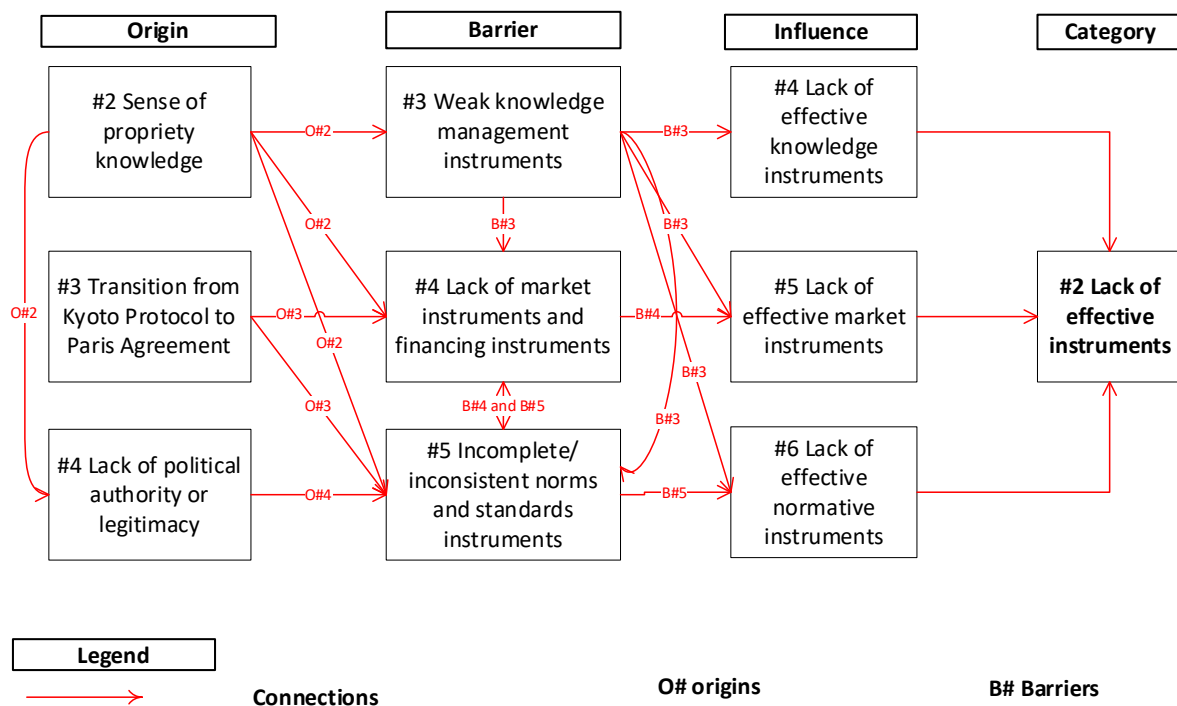
Figure 5-5 Barriers for lack of effective instruments at the global level

Source: Author

5.3.2.1   Barrier #3 Weak knowledge management

A weak knowledge management process is an emerging barrier (**section 4.5.3**), manifested beyond the failure to share knowledge. Like the broader global environmental governance space, borders and responsibilities are reasons for weak knowledge management (GINT1). However, while it may be understandable that private sector organisations protect their intellectual properties (GINT2), this behaviour is not expected of publicly funded initiatives (GINT4).

As shown in **Table 5-2**, the claims of inter-initiative knowledge sharing are forward-looking for OGCI. It also shows a discursive switch from ending flaring to preventing methane leaks (GINT5) highlighting the lack of specificity. Furthermore, although OGCI plans to launch a satellite flare tracking project with GGFR, it has not been approved (GINT6).

Table 5-2 Weak Knowledge management process in global associated gas flare governance

		RAG	Does your initiative share knowledge? If yes, how? and if not, why not?
Global interviewee code (GINT1 -11)	GINT1		"Yes, we share knowledge, but a big challenge is around borders and responsibilities"
	GINT2		"No, we do not share our experience with any of these initiatives because we would be looking for an effective way of sharing knowledge & creating new knowledge, if needed and with intellectual property protection"
	GINT3*		"Yes, we share knowledge. We have four knowledge management networks - (1) technology, (2) regulatory issues (3) financial aspects and (4) best practices - all on flaring"
	GINT4		"Yes, we share knowledge, primarily the mechanism is the annual gas flaring data which we produce in summer each year based on satellite data sourced from the National Atmospheric Agency (NOA)". "However, there is a sense of proprietary knowledge by GGFR and ZRF which is wrong"
	GINT5		"Yes, we share knowledge. We are working with UNEP to share our experience of methane implementation"
	GINT6		"Yes, we share knowledge. We have a good connection with GGFR, and we plan to launch a project to share technical information on the quantity of flare coming from each of our member companies"
	GINT7		"Put it simply, our standards are the basis for the development of all other forms of standards, within or out of the UNFCCC, but we have marketability challenge"
	GINT8-9		"Yes, we had shared knowledge when we wanted to review the AM0009 in 2010 and make it simpler, we looked for partners that can understand the sector and what kinds of things the sector wanted to see; so, we could address them. Our ability to share knowledge depends on the state of play in the market which is not favourable to CDM currently".

Note:* *validates a finding in* **Table 4-11** *for the distinct knowledge product owned by the World Bank but challenged by sense of propriety knowledge which stopped them from effectively sharing knowledge – especially with global initiatives like the OGCI.*

Source: Author

A knowledge-sharing barrier also contributes to a failure to create norms and standards. According to a UNFCCC-AM0009 interviewee, "the other initiatives could take the existing AM0009 standards and

put their logo and use them - which is acceptable as it is a public good" (GINT7). However, this is not happening; instead, there is the creation of new standards by GGFR and OGCI. When carbon credits had a better market value, CDM projects were an effective source of climate finance, the UNFCCC had greater leverage to share knowledge to create standards, but this is no longer the case.

5.3.2.2 Barrier #4 Lack of market instruments and financing

Despite arguments to create markets by the global initiatives (**section 4.3.2.2**), CDM method AM0009 is the only market instrument in this governance space, but with problems. I categorise the problems in **Figure 5-6**: Four paths from the Kyoto Protocol to the Paris Agreement into two schools of thought.

The first school of thought comes from countries that want restrictions. The arguments include "we do not want to flood the new regime with CERs, lowering prices due to supply-demand imbalance" (GINT7). The second school of thought comes from countries that do not want a restriction. These countries argue that "if you do not transition everything, you may lose the confidence of the private sector investors" (GINT7). Such a loss of confidence could stem from telling the private sector investors, "sorry, although you have invested millions, we have now changed the rules" (GINT7).
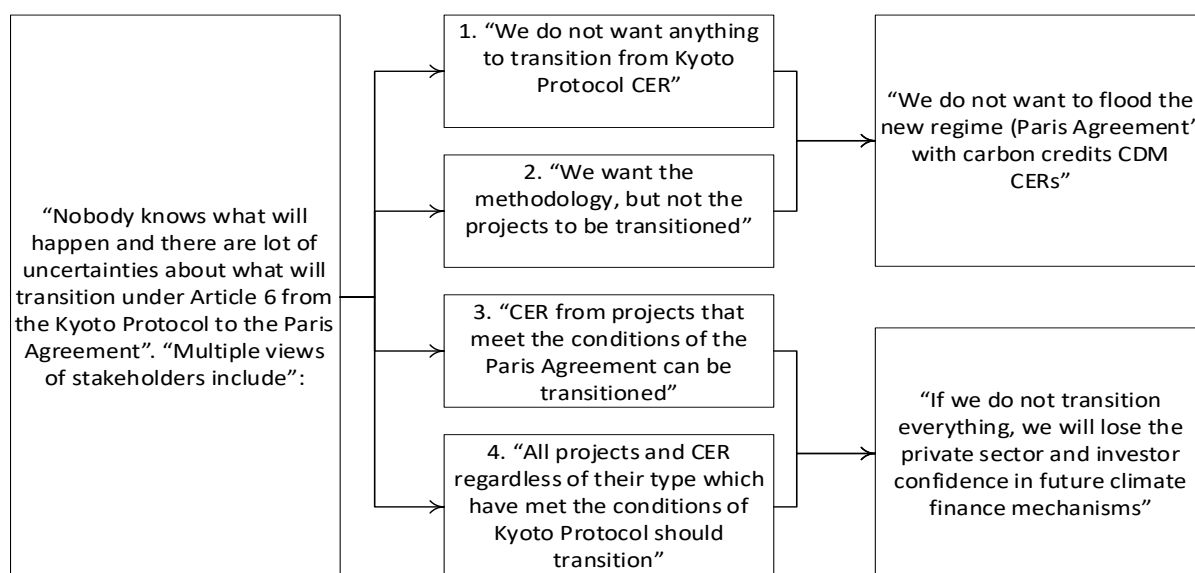
Figure 5-6 Four paths from the Kyoto Protocol CDM to the Paris Agreement Article 6

Source: Author based on insights from GINT7 and 8

There is one resonating fact in all these paths for transitioning CDM into the new arrangement under the Paris Agreement: CDM was top-down. The Paris Agreement has changed the game by being bottom-up. Article 6 of the Paris Agreement aims to promote a balanced approach to help countries translate their Intended Nationally Determined Contribution (**INDC**) to NDC. This help is provided through technical assistance and encouraging voluntary global cooperation. Unlike the NDC, which is confirmed, the INDC contains proposals.

To drive home this point of raising NDC ambitions, see the extract from the Nigerian President – where the key message is about gas consumption for growth:

The Nigerian President said.

"Nigeria is actually more of a gas than an oil producing country. Consequently, I am requesting for financing of projects using transition fuels such as gas. Nigeria has developed a detailed Energy Transition Plan and Roadmap based on data and evidence. This plan has highlighted some key facts that faces the difficult conversations. Our transition plan also highlights the key role that gas must play in the transition of our economy across sectors; and the data and evidence show that Nigeria can continue to use gas until 2040 without detracting from the goals of the Paris Agreement[6]". (*Transcript of President Muhammadu Buhari's speech at COP26 World Leaders Summit – Tuesday 2nd November 2021*)

To avoid creating stranded gas assets and enhance NDCs, the problems of AM0009 need to be addressed. Addressing the AM0009 difficulties could make it easier to raise the NDC ambition and achieve emission reduction targets from the gas sector.

As much as AM0009 is a market-based incentive instrument, it is also normative, which uses standards and hard targets, managed through a hierarchical process. There is a small window of tolerance to award a certificate of emission reduction to projects. However, in contrast to the Kyoto Protocol, the Paris Agreement uses a bottom-up approach where countries develop their NDC with the potential to access international development aid. So, the negotiations for transition and implementation of the

---

[6] Transcript of President Muhammadu Buhari's speech at COP26 World Leaders Summit – Tuesday 2nd November 2021.

new arrangement should consider the differences in the philosophies. The two approaches could affect GHG reduction from the gas sector in different ways.

5.3.2.3 Barrier #5 Incomplete/inconsistent norms and standards

All three instruments of knowledge, markets and normative are interrelated and not mutually exclusive; however, there seem to be incomplete and inconsistent norms and standards in global associated gas flare governance (GINT3 and GINT7). The global system seems rife with claims of market and knowledge instruments, not exploiting the complementary aspects of standards as enablers[7]. According to an interviewee, the obvious answer may be a globally mandated carbon tax (GINT1). However, a global carbon tax is contentious and challenging to implement. It does seem that at the country levels, normative instruments may exist. However, the ineffectiveness and lack of willingness to use them could be a barrier on its own due to a high reliance on oil revenue (GINT2).

What is missing is the initiatives' efforts to combine their collective resources and standards and use AM0009 to set a clearer/firmer path for oil companies to stop flaring. I acknowledge that while collaboration is always preferred, competition is also helpful in encouraging good governance. Although the pragmatism of a softer approach is not surprising, norms deliver a consistency to exploit the potentials for ending associated gas flaring. Furthermore, despite the existence of AM0009 as a standard for flare-out projects, GGFR is developing an associated gas flare manual in partnership with IPIECA and OGCI (GINT3), showing potential for further inconsistencies.

While there is a lack of progress in norms, it seems to make sense to allow markets to play their role in price discovery (GINT7). The Zero Routine Flaring by 2030 could become a de-facto standard to address the gaps in norms. It expects a particular behaviour from its country and company members, albeit voluntarily (GINT3). However, ZRF principles are broad-based norms, and specific standards need to be developed. ZRF 2030 has been referred to as a "rallying cry rather than the reality of ending routine associated gas flaring by 2030" (GINT4). Furthermore, there is a gap in monitored versus targeted behaviour as investment and financing decisions happen at project levels. In contrast, flare reporting happens at company and country levels, which might need to be changed (GINT1).

---

[7] Oberthür, 2009.

5.3.3 Barriers to efficient processes at the global level

As presented in **Figure 5-7**, the third main result of the analysis is that three process related barriers originate from a lack of systems thinking which was an emerging barrier. The detailed analysis of interviews shows that a lack of systems thinking has at least eight connections to the three influences of the barriers for global associated gas flare governance process.

Goals are an endpoint of what the actors want to achieve, and processes are the route from the present to the goal, and actions are steps along the way. An efficient process translates goals into action, securing broader buy-in and may lead to better progress. However, the results show this may not be happening due to the three barriers. First, it seems the global initiatives may not be connecting the dots between their activities and that of others. Second, this failure to connect the dots appears to be leading to duplication of activities, few flare-out projects and degrees of frustration, among other barriers.
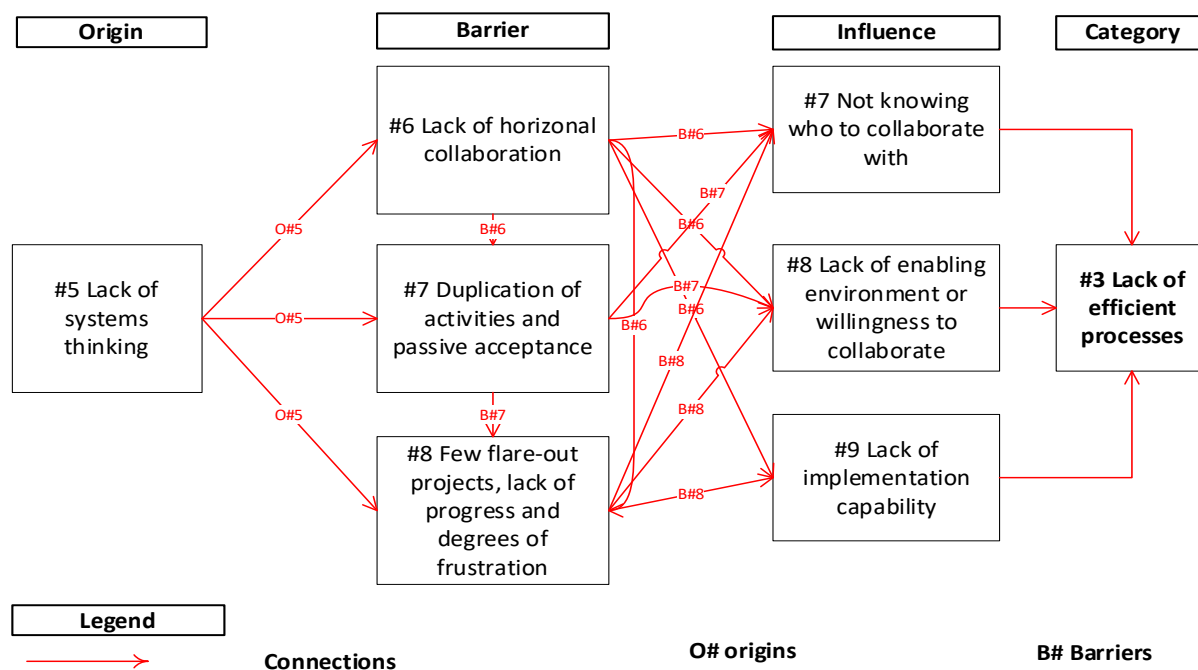
Figure 5-7 Manifested barriers for lack of efficient processes at the global level

Source: Author

5.3.3.1 Barrier #6 Lack of horizontal collaboration

An investigation into the potential for weak knowledge management processes led to an overwhelming view of a lack of horizontal collaboration, highlighted in **Table 5-3**. While there was only one dissenting view on a lack of horizontal collaboration, it seems to be happening.

According to two interviewees, "the initiatives are probably not geared to work on implementation and instead circle the policy drain – drafting policy, after policy" (GINT1 and GINT2). However, a lack of horizontal collaboration seems to be a reality of international development work (GINT3 and GINT4).

The dissenting view is worthy of note. It claims that the barrier arises from the fear of moving at the slowest initiative/collaborator's pace (GINT5). However, the need for goal coherence (GINT6) to solve the collective problem of flaring (GINT7 and GINT8) should encourage more substantial horizontal collaborative efforts.

A lack of horizontal collaboration contributes to inconsistencies and wasted efforts (GINT1)**.** Indeed, the counterfactual is making progress at the pace of the slowest or more influential initiatives, leading to delays in meeting critical milestones (GINT5). In addition, there are times when critical stakeholders like IPIECA need to be aligned before progress can be made (GINT3). However, the argument of moving at the pace of the slowest initiative does not hold against the other interview evidence. For example, an interviewee asserted that:

"There is an issue with the current pace of change and a question of the scale of change. We need to move faster to get ahead of the problem. It is not easy, but this audacious goal of greater horizontal collaboration is needed" (GINT7).

Another interviewee added: "Just because horizontal collaboration has its challenges, it does not mean a lack of working together is acceptable" (GINT4).

Table 5-3 Perceptions of lack of collaboration in global associated gas flare governance

		RAG	Perceptions
Global interviewee codes	GINT1		"The very simple answer is yes, it must do; as there must be extra cost, effort, due to a lack of collaboration at every turn which also harms the level of advocacy for a very important set of initiatives".
	GINT2		"I think the main challenge is none of the organisations are genuinely interested in creating projects on flare reduction. They are not geared to do what is needed and play in the space of flare reduction at the scale needed".
	GINT3		"It is always good to be well coordinated, but no I mean in general (a lack of working together) you may be surprised to hear me say that actually no". "So, it's a very slow process in terms of us being able to get all round endorsement. It takes a while for us to be able to get to all of these organisations, companies, and governments".
	GINT4		"Yes, I mean I would take issue with that phrasing of the question. I think it is an assumption you have made". "The question is phrased in a way that you are assuming there are challenges". "I think there are always barriers to collaboration amongst institutions and organisations".
	GINT5		"While we can improve the level of engagement, I would place the improvement of engagement as a trade-off with being able to deliver results". "The risk of working too much together is that you end up with the lowest common denominator and a pace of development and progress that is extremely slow".
	GINT6		"So, it is important to have a clear vision and work together in synergy with different initiatives that have the same objective. There is also the external perception of the work of the initiatives that there is a lack of synergies".
	GINT7		"Yes, this is a key issue because the challenge we are facing with climate change requires a response; at scale (large) and fast enough - there is an issue with the current pace of change and an issue of scale of change".
	GINT8 - 9		"Yes, in some spaces the World Bank has created collaborative instruments on their own called Pilot Auction Facilitation (PAF) where they buy only methane credits, so, not from oil and gas sector".
		Legend	
			Interviewee perceived no lack of collaboration
			Interviewee perceived a mixed view
			Interviewee perceived lack of collaboration
			Interviewee perceived something else

Source: Author

5.3.3.2   Barrier #7 Duplication of activities and passive acceptance

Extending the line of enquiry on weak knowledge management to that of duplication of activities also led to a view that it is a barrier as captured in **Table 5-4**.

Five interviewees believed there was a duplication of activities. One was uncommitted, but one felt that there was no duplication. The initiatives duplicate activities in policy planning, norms and standards. In addition, knowledge production and knowledge sharing cover the same problem, where there is a lack of consistent messaging (GINT4). For example, an opinion of one of the interviewees

was that OGCI could share knowledge from external sources with its members to act more effectively on ending flaring (GINT5).

Interestingly, the triangulation between the manifested barrier of lack of specificity and this barrier shows a passive acceptance. For example, one interviewee said, "this is something we deal with as an unavoidable cost of international interventions" (GINT3). Notably, this challenge could exist due to the politics of sponsors. Added layers of activities could be helpful in other areas. For example, data collection, where more data collected could mean better accuracy over time (obviously, subject to parsimoniousness).

Table 5-4 Perceptions of duplication of activities at the global level

		RAG	Perceptions
Global interviewee codes	GINT1	🟥	"The issue of gas flaring reduction is a wicked problem and is never isolated but bracketed with issues if sustainability – divert gas to generate electricity and treat it as a transition fuel. Just looking at the goals of the initiatives, it is quite clear that there are overlaps".
	GINT2	🟥	"They duplicate activities like influencing or advocating and policy. Everyone feels comfortable about writing stuff (policy)".
	GINT3	🟥	"I do not know; I would have to look into the specifics but certainly in general there are overlaps, because when you talk about gas flaring, gas is primarily methane, so if you're reducing gas flaring you are also reducing methane emissions overall. So, I do not know if I can answer your question thoroughly. I just could say certainly there will be overlap".
	GINT4	🟥	"So, I think that there is some overlap. That there are slightly different orientations and approaches and the lens that they use to look at these issues. I think I agree with you".
	GINT5	🟩	"Zero Routine Flaring is a sub-initiative of the GGFR, so I think those two are quite complementary because they are designed by the World Bank. Zero Routine Flaring is just a call for setting the target, while GGFR is more focused on identifying and sharing best practices. The Global Methane Initiative is dedicated to methane reduction. There are a number of other initiatives that are exist focused on reducing methane emission where there are overlaps, it is not but among the five you listed".
	GINT7	🟧	"Yes, we can say that in some areas, maybe they overlap. However, there are other areas where we can say that they complement each other".
	GINT8	🟥	"Yes, to some extent they all overlap and, in some cases, they have other activities as well".
Legend			
🟥	Interviewee perceived duplication.		
🟧	Interviewee perceived a balance between duplication and complementarity.		
🟩	Interviewee perceived no duplication, more complementarity.		

Source: Author

5.3.3.3   Barrier #8 Few flare-out projects, lack of progress and frustration

One manifested barrier linked to a lack of systems thinking is that there are over 16,000 flare sites globally but only a few implementation programmes (GINT2). ZRF 2030 has no projects. It is only a commitment to report (GINT3). GGFR initially had in-country project design activities, but this seems not to be the case anymore (GINT2). In addition, OGCI focuses on catalysing growth through putting their $1 billion into mostly CCUS and methane-leak measurement detection investments. OGCI acknowledges that it needs to do more on flare reduction (GINT5). However, there seems to be no action to increase focus on flare reduction projects (GINT2) which I also confirmed by reviewing OGCI's investment portfolio[8].

As shown in **Figure 5-8**, except for ZRF 2030, the initiatives could collaborate with project implementers to execute projects to capture and use gas, but they hardly do so. ZRF 2030's result is not surprising as it focuses on reporting. Not surprisingly, OGCI does not engage with project financing partners. OGCI members have committed $1 billion; however, more could be done for associated gas recovery projects. For the UNFCCC, they engage with DNA, DOE and project implementers to implement projects. As of 2013-14, UNFCCC was developing financing arrangements through their collaboration with Regional Development Banks[9].

The above-interrelated results mean there could be overfinancing one area and underfinancing another arises because of a lack of collaboration. "As a result, they do not use their funds effectively and leverage them to achieve a broader impact" (GINT7). According to a UNFCCC interviewee, assuming more coordination and horizontal collaboration, GGFR and AM0009, who have similar goals, could bring projects into a collective portfolio. Such an action could generate the required financing (marketability issues aside) (GINT8). However, the last time UNFCCC AM0009 and GGFR team met in the siloed space was in 2010, but I supply a solution in **section 6.2.3.**

---

[8] OGCI, "Our Investment Portfolio – OGCI."

[9] "CDM: stakeholder," UNFCCC, accessed 10 May 2021, https://cdm.unfccc.int/stakeholder/index.html.

	GGFR	UNFCCC AM0009	GMI	OGCI	ZRF 2030
Coordination with project implementers	Yes – for project implementation	Through DNA and DOE and Sponsors of PoA	363 network members	CCUS and other non-flare innovation	Not applicable as they only set goals
Coordination with project financiers	Yes – to provide financial guarantees	Regional Development Banks	9 financial institutions	Self – finance projects	
Coordination with project technical partners	No clear evidence	Designated Operating Entities	Private sector companies	Private sector technical partners	

Figure 5-8 Coordination of activities with project implementers

Source: Author

We know that there are over 16,000 flare sites globally. According to an interviewee, flaring is expensive to tackle, especially when this requires putting in place a pipeline and transporting it hundreds of miles to an operational use site (GINT3). It requires at least $100 billion investment to end flaring. However, as shown in **Figure 4-5**, there has been no new project on the CDM AM0009 portfolio (the only market instrument) since 2015[10]. Developing countries create their NDCs with the conditionality of aid which needs to be funded. Besides, developing countries rely on climate financing for their gas projects when there is marketability failure.

The above also means there are degrees of frustration from external and internal members of the initiatives. For example, the most vocal interviewee said:

 "There are multiple interventions with minor differences in goals and limited traction. So, if you look at the result, even initiative staffs express a degree of frustration" (GINT2).

This level of frustration was indeed echoed by another interviewee in one of the initiatives who said, "we need to achieve more, faster" (GINT7).

---

[10] "CDM: Project Activities," UNFCCC, accessed 10 May 2021, https://cdm.unfccc.int/Projects/projsearch.html.

5.4   Manifested barriers for Nigerian associated gas flare governance

Research objective 4: to trace manifested barriers and origins for the systematised (b) global associated gas flare governance: **Figure 5-9** visualises the interconnectivity between barriers, their origins and influences at the Nigerian abstraction level. The relationships are more complex than those at the global level, symbolising more rooted barriers.

For example, **Figure 5-9**, models a total of 99 connections: 11 origins-to-origins, 29 origins-to-barriers, 28 barriers-to-barriers and 31 barriers-to-influences connections.
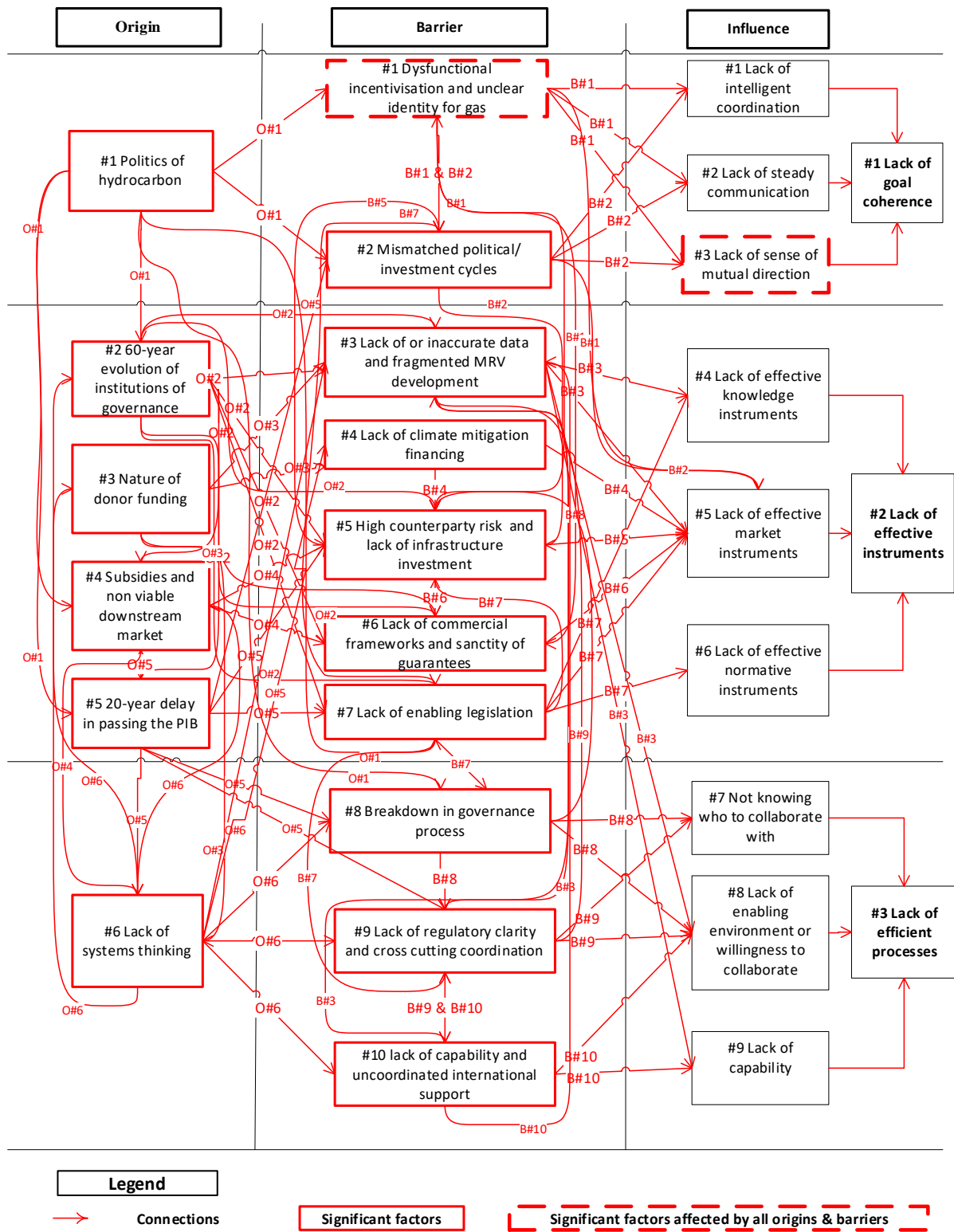
Figure 5-9 Visualisation of the connections at the Nigerian level

Source: Author

5.4.1   Barriers for goal coherence at the Nigerian level

As presented in **Figure 5-10,** the first main result of the Nigerian level analysis is that there are at least two barriers to goal coherence. Dysfunctional incentivisation and an unclear identity for gas and mismatched political/investment cycles originate from the politics of hydrocarbons and collectively influence the three influences for lack of goal coherence. Each of the four barriers manifested under lack of goal coherence is linked back to emerging barrier #2.

The politics of hydrocarbons is also an origin for barriers to effective instruments and collaborative processes. The high dependence on oil revenue means Nigeria's options to ending flaring through effective governance instruments are limited. In addition, personal interest potentially contributes to a breakdown in the governance process, which is a barrier to effective collaboration. Each of the two barriers is unpacked to show their interconnectivity and how they manifest.
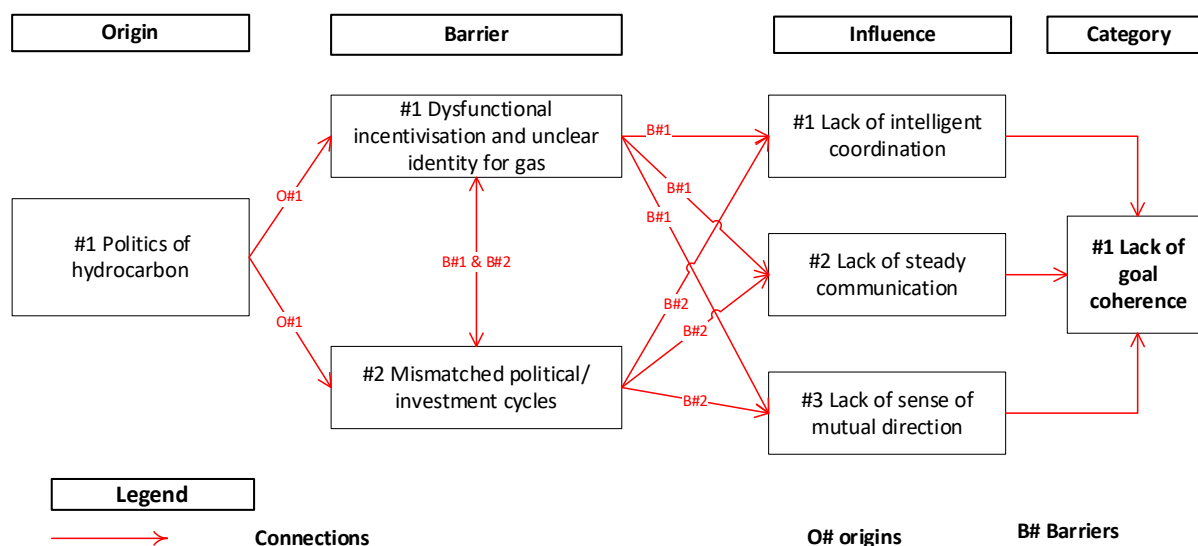
Figure 5-10 Barriers for lack of goal coherence at the Nigerian level

Source: Author

5.4.1.1   Barrier #1 Dysfunctional incentivisation and unclear identity for gas

Incentives are a means to encourage investors in critical sectors like gas-to-power or gas-to-clean cooking. However, in Nigeria, incentives do not reach the appropriate type of investors or sectors, amplifying a mismatch between investment and political cycles. For example, according to an

interviewee, "gas-to-power incentives have been diverted to textiles to resurge the industry, which is important to the northern politicians" (NGN10).

Notably, there are hardly any national incentives without critique's views on its dysfunctionality, often depending on the critics' philosophical lens or politics. For example, the UK's "levelling up agenda" has been critiqued for being targeted at securing labour party voters, despite its claims of increasing social mobility and reducing geographic inequalities. However, it could also be criticised for the politics of breaking down the so-called red wall[11].

In Nigeria, critics argue that the dysfunctionality of incentivisation is a power grab by the northern elites. Notwithstanding the argument's merits, the politically imposed barrier leads to retrospective changes to associated gas off-take contracts to make room for new agreements, showing a lack of sanctity of agreements (NGN19). According to an interviewee, Nigerian governmental organisations do not pay their debts, leading to investors' bankruptcy (NGN2).

An unclear commercial and climate action identity for gas is the second part of this barrier and is a point of convergence for multiple barriers. This manifested barrier is connected to all the six origins and 10 barriers. Its connectivity is due to the lack of gas identity. It may mean that gas can neither be used effectively for its climate change mitigation potential or commercialisation. As one interviewee said:

 "With little to no clarity in the 1969 Act on gas investment framework, associated gas is struggling for its own commercial and climate change identity" (NGN10).

A consensus view was that "there are too many loopholes in the 1969 Act to make it an effective legislative instrument" (NGN16, NGN17 and NGN18).

Besides, "a lack of legislation makes it easier for oil companies to successfully lobby and overturn good governance initiatives secured through policies and Executive Orders" (NGN3, NGN4, NGN5 and NGN6). Notably, I raised concern in **section 4.4.2** about securing the 2017 gas policy through an Executive Order.

This barrier makes it difficult to realise the NDC goal that is 40% dependent on gas and increases the risk for investors (**section 4.4.1**). More worrying is the unresolved differences between the Executive and the Legislatures, which means this two-decade-old barrier may not be addressable. Indeed, "over

---

[11] Alex Davenport and Ben Zaranko, *Levelling up: where and how?* (The IFS, 2020), https://www.ifs.org.uk/publications/15055.

two decades of failure to pass a single gas-specific law is a significant legislative barrier" (NGN1) to making use of gas either commercially or for climate change mitigation.

5.4.1.2   Barrier #2 Mismatched political/investment cycles

Political cycles are usually five years and are shorter than a gas infrastructure investment cycle. In Nigeria, this mismatch is intensified by a lack of political manifestos, which also means a lack of continuity and sustainable leadership. For example, one interviewee said each Minister starts their associated gas commercialisation programme, abandoning earlier progress (NGN1).

However, one Minister of State for Petroleum, Ibe Kachukwu, has supplied continuity, carrying on the vision of the associated gas flare commercialisation programme from an earlier Minister (NGN3-6). The first associated gas flare commercialisation vision was started under the People's Democratic Party but turned into a programme by the All-People's Congress under President Muhammadu Buhari. However, this exception in continuity does not detract from the challenge of a lack of leadership that sustains suitable interventions from one government to the others. One interviewee argued that:

 "Politicians get elected and think to act with that election cycle; the first 1-2 years is confusion, but there is an element of efforts. Then as the political cycle progress, they focus on short term strategies to aggregate funds for the election, with long-term projects no longer the priority. Then they come back for the 2nd term and restart, but then they realise they are about to finish the term and associated gas flare-out projects takes 6-8 years to complete, which means they would no longer complete the project" (NGN11).

5.4.2   Barriers for effective instruments at the Nigerian level

The second main finding of the Nigerian level analysis is **Figure 5-11,** which outlines four origins that account for five manifested barriers, which influence a lack of effective instruments.

For example, a 60-year governance evolution first appeared as an emerging barrier from **section 4.5.2**. However, it is now an origin due to the chequered process, which led to multiple government machinery changes, retrofitting existing mechanisms and unconnected government agencies.

For example, a lack of accurate data arises from DPR's (the gas regulator) reluctance to use independent data from the National Oil Detection and Response Agency (**NOSDRA**). DPR is a Ministry of Petroleum Agency, while NOSDRA is an Agency of the MoE. Second, the 60-year institutionalisation

process explains the lack of infrastructure investments due to a lack of investor trust and relevant commercial frameworks. The three other origins are linked to the emerging and manifested barriers in various ways.

Origin #3, the nature of donor funding is connected to the emerging barrier of an uncoordinated capability building process for the DCC (**Table 4-14**). In addition, a reluctance to fund fossil-fuel related projects by international donors seems to have contributed to the lack of climate financing.

Origin #4 relates to the subsidisation of Nigeria's hydrocarbon and electricity sectors, which means gas-to-power contracts lack open market pricing. Unpredictable tariffs worsen this origin's effect. In addition, a high government as a counterparty risk contributes to a collapse of the electricity market.

Origin #5, the 20-year delay in passing gas-specific legislation or PIB, first surfaced in **section 4.4.1**. It affects the lack of infrastructure investments and means there is a lack of enabling legislation. The lack of gas-specific legislation may become one root origin, further explored in **section 5.5.2.2**.
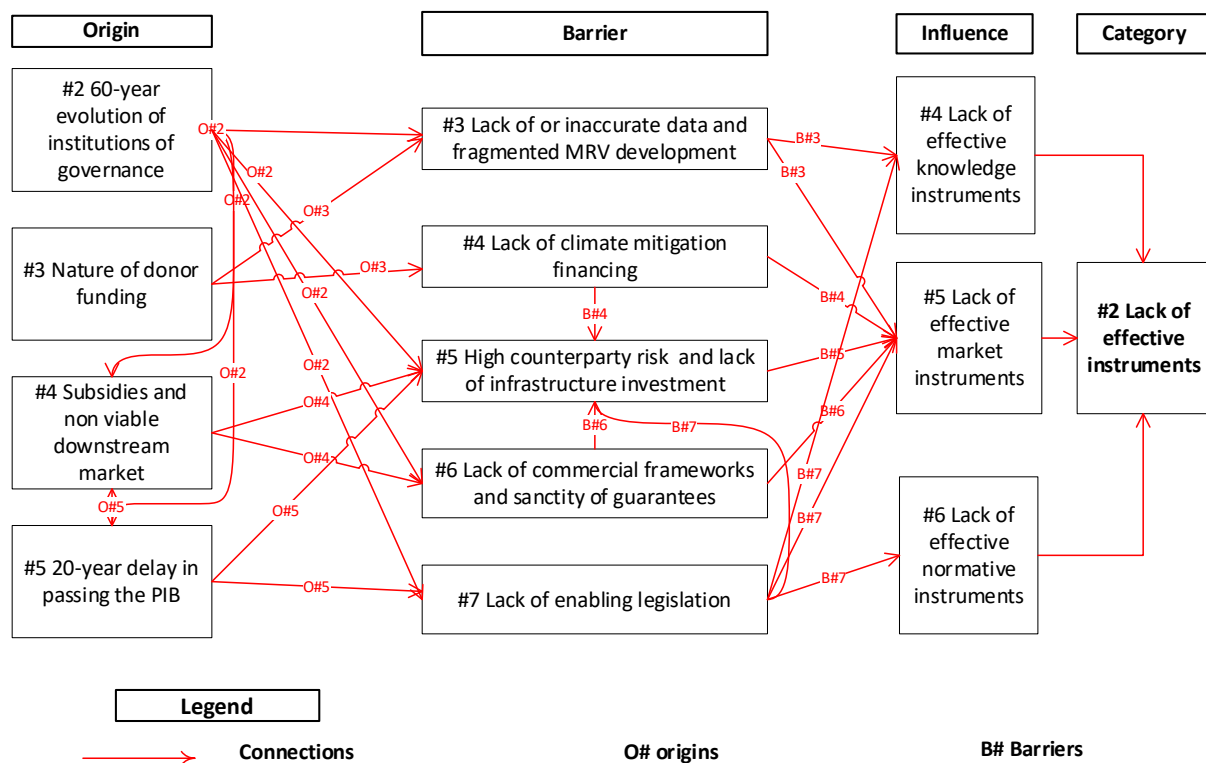
Figure 5-11 Barriers for lack of effective instruments for the Nigerian level

Source: Author

5.4.2.1   Barrier #3 Lack of or inaccurate data and fragmented MRV development

Nigeria does not have an **MRV** framework (NGN12-13). However, both the **DCC** and **DPR** independently building their MRV, leading to a two-part barrier, starting with targets. First, associated gas production is tied to oil exploration. According to an interviewee (NGN10), "it is simply not enough to use the development plan of the oil companies to project its associated gas generation as is often done in Nigeria". Second, while estimates are vastly used in the gas sector for contingent assets, this could be within more explicit limits to set bankable targets.

To enhance Nigeria's NDC and data capability, international donors are funding an MRV framework for DCC, but without effective horizon scanning to know DPR is building an MRV. DCC lacks an MRV framework and, through international support mentioned earlier (**section 4.5.3**, **Table 4-14**), they are building one (NGN12 and 13). According to three interviewees, DPR is building its own MRV (NGN7, NGN8 and NGN11); but without collaborating with DCC. The barrier is essential because Nigeria does not have a cross-coordinated MRV.

Furthermore, under-reporting of flare data and allegations of lost penalties of around $400 million annually exist due to inaccurate data (NGN10 and NGN 3–6). At best, this barrier leads to data incompatibility. However, at worst, it could lead to incoherent reporting, and it is a waste of Nigerian and global taxpayers' money. It is also possible that the DCC could not convince DPR to work together, or vice-versa, but it is evidence of a barrier. In pressing DPR interviewees for why they are not working with DCC, the response was, "it is above my paygrade" (NGN11).

5.4.2.2   Barrier #4 Lack of climate mitigation financing

Nigeria's NDC is 40% dependent on gas. However, despite promises (by DPR) to access climate finance, bidders in the associated gas commercialisation programme have been informed that it is now unlikely[12].

A lack of climate financing has consequences for Nigeria's paths to a lower-carbon future. Nigeria has significant electricity and clean cooking facility gaps and switching to associated gas takes time and financing. It is theoretically possible that Nigeria leapfrogs from basic gas consumption to a renewable

---

[12] "Frequently Asked Questions. Nigerian Gas Flare Commercialisation Programme," NGFCP, accessed 10 May 2021, https://ngfcp.dpr.gov.ng/resources/frequently-asked-questions/.

energy revolution. However, it is a significantly expensive endeavour with social justice implications, assuming Nigeria can accept stranded gas assets of trillions of dollars.

As highlighted earlier (section **4.5.2**), as of 2013, Nigeria's climate financing needs were closer to $142 billion but with a critical intervention case. This is because Nigeria loses millions of dollars in flared associated gas, which damages the environment. Unfortunately, however, the climate mitigation financing is not forthcoming as lucidly captured by two interviewees:

"I was shocked that Nigeria, despite its potential, cannot access international climate financing" (NGN12).

"Before we started supporting Nigeria, I thought it would have a significant percentage of climate financing. However, it has the lowest figures compared to smaller countries" (NGN13).

While Nigeria could generate close to $800 million annually from commercialising associated gas, this opportunity is stifled by multiple barriers. For example, one interviewee claimed, "Nigeria's domestic gas market is huge if Nigeria tackles unattractiveness to infrastructure investors" (NGN8). However, another group of interviewees countered that "there are governance and economic barriers which make solutions unrealistic" (NGN16-18).

Nigeria's climate mitigation financing gap could lead to a lack of change in attitudes and policies to transition from a coal-powered economy to a lower carbon footprint at its own cost. A potential solution is to focus on associated gas for clean cooking demand, which is less complex than gas for power. For example, according to an interviewee, "clean cooking has smaller infrastructure investments need and hardly any counterparty risk as suppliers deal directly or closely with end-users" (NGN19).

5.4.2.3 Barrier #5 High counterparty risk and lack of infrastructure investment

A high counterparty risk involves Nigeria's government-owned agencies as consumers of gas-to-power. The government agencies do not pay their debts when due, which leads to cash flow uncertainty for private sector investors (NGN2). Quite intricately linked as an explanatory factor to this barrier and potentially the biggest inhibitor is the collapse of the power sector.

According to another interviewee, "unless the power sector is restored, Nigeria cannot generate investment in infrastructure from the private sector" (NGN1). As a result, while a large quantity of associated gas could be consumed to generate electricity, the downstream sector and electricity market is effectively bankrupt (NGN2). The same interviewee said, "the electricity sector today is technically insolvent, and the government spends millions of dollars a day to keep it afloat" (NGN2).

Another interviewee said:

 "After going through an intense process of building infrastructures, you start supplying the Nigerian Bulk Electricity Trading Company (**NBET**). NBET is the government entity that is supposed to ensure you are paid. They do not pay you, and months would go by. Then they pay you 50% and say, "manage that one ah; ah-ah, we too have not been paid and una too greedy oh!" (*This is Nigerian Pidgin English – slang but captured verbatim*) (NGN2).

The NBET was set up to make it easier for associated gas harvesters to sell their gas in bulk and secure liquidity. However, it seems to be failing in its duty. NBET aggregates associated gas and sells it to power generating companies called Generating Energy Companies (**GENCOs**). GENCOs, who in turn generate power and sell to distribution companies called Distribution Energy Companies (**DISCOs**). DISCOs distribute power to individuals and businesses but struggles to pay GENCOs, who in turn struggle to pay gas harvesters, and the problem starts with consumers not paying their bills. Unless Nigeria proves to be a good sovereign credit risk, it may struggle to create infrastructures for gas flare commercialisation. Besides, the electricity sector may be effectively bankrupt[13].

Indeed, it should not be the case that Nigeria props up the electricity and gas-to-power sector with high counterparty risk. While demand for gas-to-power and gas-to-cooking is high, the latter has a lower counterparty risk profile.

As shown in the abstraction (**section 1.3**), over 48% (77 million) and 90% (178 million) citizens have no access to electricity or clean cooking facilities. This demand profile means investors could be encouraged to build gas infrastructures and supply electricity and clean cooking gas: assuming affordability is not a barrier. However, more worrying is the possibility that Nigeria could become the third most populous country globally by 2050[14]. This concern is in the context of a growing electricity consumption gap in an effectively bankrupt electricity market.

An emerging barrier was a lack of infrastructures which manifested here. One interviewee argued that "there is a challenge of developing credible gas infrastructures plan that is synchronous with our national development" (NGN1). The last gas infrastructure Nigeria built was during the era of a

---

[13] PwC, "Solving the Liquidity crunch in the Nigerian Power Sector,"(White Paper presented at Power Sector Roundtable Conference 24 September 2019), https://www.pwc.com/ng/en/publications/solving-the-liquidity-crunch-in-the-nigerian-power-sector.html.

[14] UN, *World Population Prospects* (UN, 2017), https://population.un.org/wpp/Publications/Files/WPP2017_DataBooklet.pdf.

dictator in the 1980s. There seem to be no committed up-to-date infrastructure development plans, which the private sector investments need.

Without infrastructures, the regulatory focus should be on making processes more effective, not on price. As one interviewee put it, "although focusing on processes might mean the private sector investor profits in the short run, eventually, the country benefits" (NGN1). The actual challenge is how to ensure access for smaller and new players. The focus should be on creating a competitive environment and preventing incumbents from abusing their position when Nigeria has little leverage.

The reality is that Nigeria depends so much on oil revenue. Indeed, Nigeria's gas market challenge is unique and revolves around a lack of investment in infrastructures. No new infrastructure has been built in the last four decades (NGN11). However, a lack of access to gas harvesting infrastructure may be a symptomatic barrier. The problem stems from a lack of investor trust (NGN1).

5.4.2.4   Barrier #6 Lack of commercial frameworks and sanctity of guarantees

Nigeria's lack of commercial frameworks and sanctity of guarantees creates a stalemate for its intentions of regulating the gas sector. It contributes to its situation of being held hostage by the oil companies. As one interviewee put it:

"There are billions of dollars revenue from ending flaring and using associated gas. However, we are being held hostage by the oil companies and may lose in a standoff" (NGN2).

Another interviewee captured the standoff by saying:

"We are in a stalemate with the oil companies on how we can get them to stop flaring" (NGN1).

A lack of commercial frameworks is related to Nigeria's high dependence on oil revenue. It shows "there is a no-real will to solve the flaring challenge given current circumstances" (NGN16-18). The commercial associated gas framework was not initially well-designed. Nigeria is using old laws to force oil companies to commercialise gas (NGN3-6). See Error! Reference source not found. for my illustration of the Nigerian standoff.
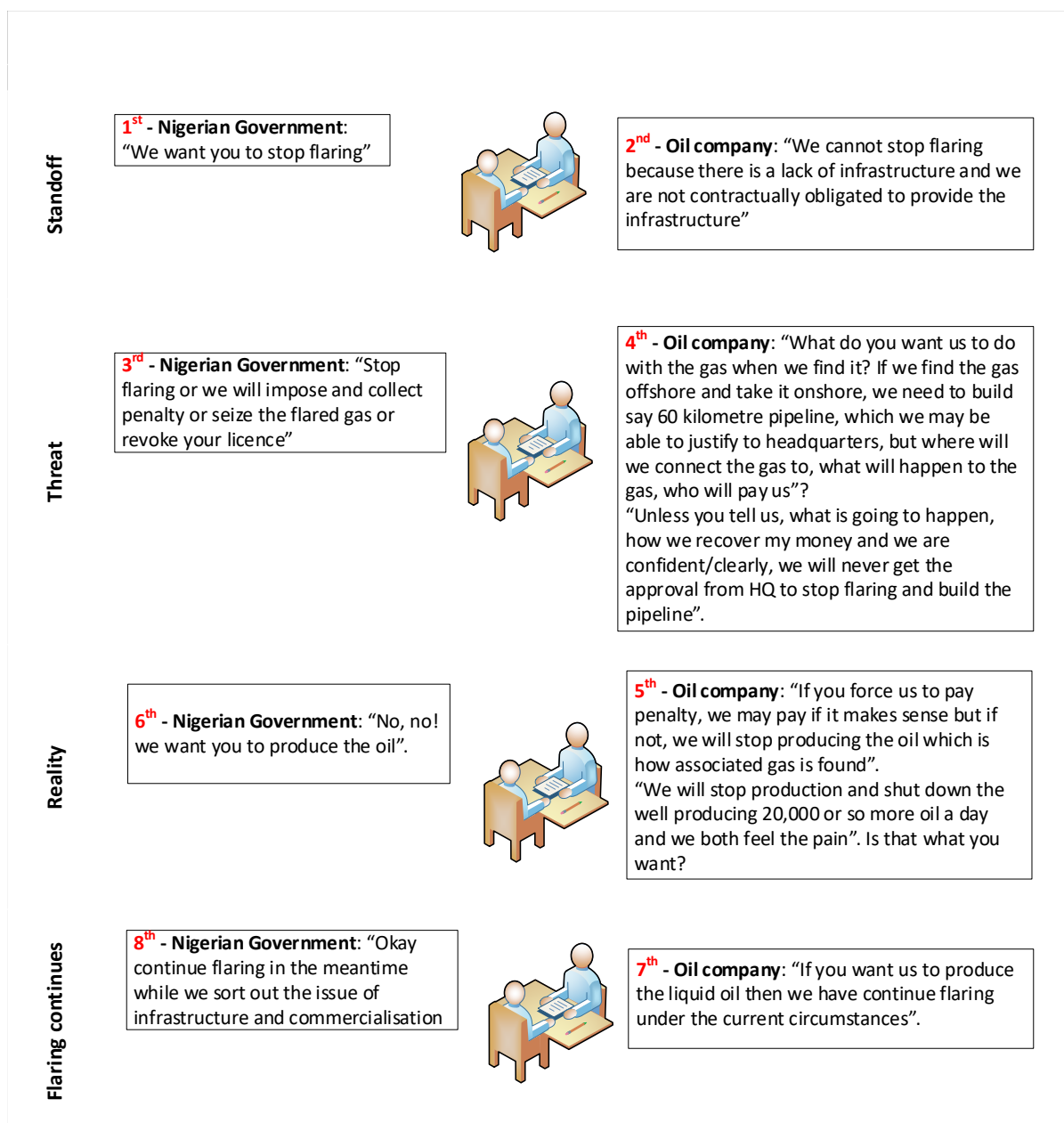
Figure 5-12 The Nigerian flare-out standoff – Nigerian government and oil companies

Source: NGN1 and NGN2

A lack of sanctity of guarantees is another related barrier in Nigeria's associated gas commercialisation programme. According to one interviewee (NGN19), it was not what they received (**Figure 5-13**). Two insights apply: First, as outlined in **Figure 5-13**, 25 top flare sites were promised to investors. However, 23 sites were unusable because of the distance from shore or unattractive economically (NGN19). Second, while the profile of the flare sites in the green and grey zones are not the worst, and certain investor types may prefer them, it was not what was promised (NGN19).

An increasing uncertainty of completion and a rising development cost means potential investors have dropped out of the process. Assume a project developer spends $500,000 a year keeping staff, developing plans and engineering design. If the investor planned to commit $1.5 million to this programme, they would have exhausted their funds after 4 years of waiting (2016 to date). As highlighted in a scathing REUTERS report, the delays and lack of sanctity of guarantees and other unique issues have meant investors pulled out of the programme[15].
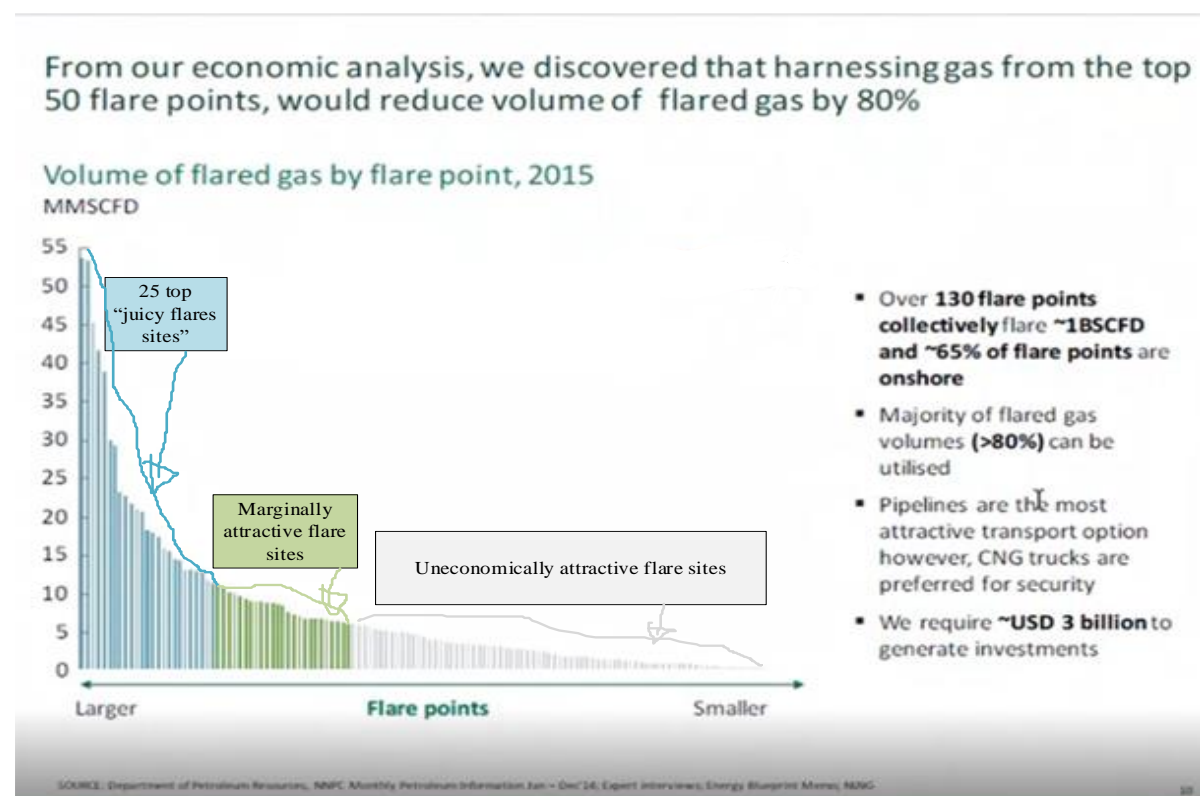
Figure 5-13 Commercialisation programme viability curve

Source: Presentation to gas commercialisation bidders[16]

---

[15] Libby George, "Nigeria's pioneering gas flaring plan risks going down in flames," *Reuters*, 30 September 2020, https://www.reuters.com/article/us-nigeria-oil-gasflaring-insight-idUSKBN26L195.

[16] Nigerian Gas Flare Commercialisation Programme, "The Journey So Far & Next Critical Steps". A Presentation to the Honourable Minister of Niger Delta Affairs.

5.4.2.5   Barrier #7 Lack of enabling legislation

A lack of enabling legislation is a three-part barrier manifested from **Chapter 4**. However, it extends to a lack of climate legislation, weak reporting and allegation of corruption. A lack of legislation means the 2017 gas policy wins are unsustainable at its fundamental level, should a new government choose to reverse it. Furthermore, investors have limited protection.

Reporting by the oil and gas companies for flaring and climate initiatives is currently voluntary and not working. One interviewee argued that "there is a need for a legislation that would compel the five sectors in the NDC to respond to reporting requests" (NGN9). Furthermore, there is a lack of climate action legislation. As one interviewee said:

"From a regulatory point of view, the challenges are everything we do around regulation requires a clear form of regulatory instruments that supports the full implementation of our initiatives" (NGN8).

There are allegations of a corrupt process and inaccurate data by the oil companies, as one interviewee claimed:

"There are accusations of collusion between DPR and international oil companies as the DPR data reporting does not match NOSDRA data. Estimates of lost revenue are between $400m to $500m annually. The lost revenue is due to the lower data by DPR who take self-reporting figures from the oil companies without the ability to access its accuracy" (NGN10).

5.4.3   Barriers for an efficient process at the Nigerian level

Figure 5-14 outlines a lack of systems thinking as an origin to three barriers that collectively lead to a lack of effective collaboration processes. At the Nigerian level, the lack of systems thinking expands to an outright breakdown in the governance process. Furthermore, it seems the 60-year development of the institutions of governance and the delay in passing a PIB mean a lack of clarity in regulators, contributing to a lack of cross-cutting coordination. In addition, the international actors may be contributing to the problem due to the uncoordinated donor support to build the capability of the DCC.
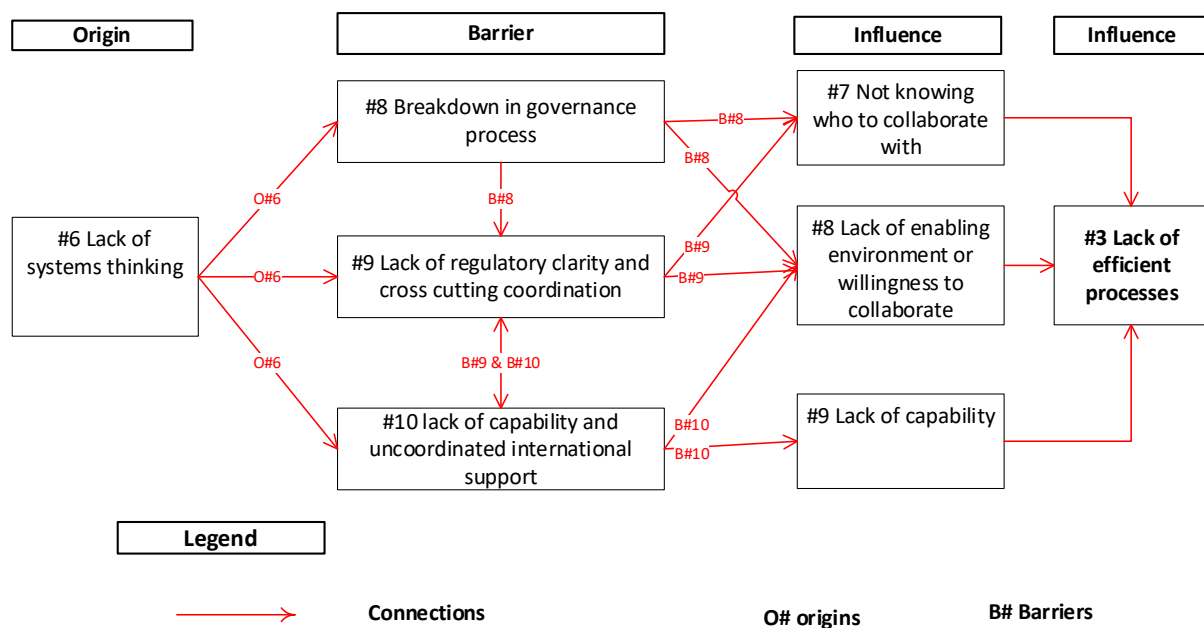
Figure 5-14 Barriers for lack of efficient processes at the Nigerian level

Source: Author

5.4.3.1   Barrier #8 Breakdown in the governance process

Nigeria's dependency on oil revenue and NNPC's positioning in the oil value chain may have led to a breakdown in the normal governance process. It seems the Minister of State for Petroleum lacks the authority to direct Nigeria's hydrocarbon governance[17]. According to an interviewee, "Nigeria has a series of informal cabals that effectively short-circuit normal governance" (NGN10). Another interviewee said, "there is always Ministerial, Departmental and Agency politics at play" (NGN19).

This barrier was heightened when the associated gas flare commercialisation programme was moved from MPR to DPR. One interviewee claimed, "DCC was not involved in the commercialisation programme design" (NGN10). Another interviewee said, "we unsuccessfully tried to get DCC involved; it seems they are only interested in the World Bank and UN-funded projects" (NGN1).

Interestingly, it seems oil companies could exclude flare sites from the programme despite assurances that this would not happen (NGN3-6). There was an allegation that after promising bidders "70, then

---

[17] Samuel Ogundipe, "Petroleum Minister Kachukwu writes Buhari; accuses NNPC GMD Baru of illegalities, insubordination," *Premium Times Nigeria*, 3 October 2017, https://www.premiumtimesng.com/news/headlines/244890-petroleum-minister-kachikwu-writes-buhari-accuses-nnpc-gmd-baru-illegalities-insubordination.html.

40 juicy flare sites, this has not been followed through transparently" (NGN19). Another group of interviewees said, "certain flare sites were excluded from the auctioning basket by the Minister, despite guarantees against such actions" (NGN3-6). A counterfactual is that the oil companies "were allowed to exclude the sites because they had made progress in converting the flared gas to power" (NGN7, NGN8 and NGN11). The oil companies may have acted rationally by starting a flare-out programme to exclude their sites. However, it does not detract from the broken guarantees.

5.4.3.2 Barrier #9 Lack of regulatory clarity and cross-cutting coordination

A lack of regulatory clarity first surfaced as an emerging barrier #11 (fragmented governance process) but is manifested with added insights.

While there is a plan to create a single regulator (Department for Gas), it cannot be implemented without the PIB, leading to an unclear regulatory environment. DPR still regulates both the up and midstream gas sector (NGN1). It may take years of transforming the NNPC to reduce its grip on the commercial and regulatory environment (NGN7). Another interviewee argued that "a lack of PIB means lack of clarity as promised in the 2017 policy" (NGN10), which aligns with other results. For instance, the rules constantly change too often for investor confidence, sending the wrong signals to potential investors (NGN8).

NNPC and its subsidiaries have traditionally been viewed as the real regulators, and DPR is territorial and plays turf wars (NGN3-6, NGN10 and NGN19). Indeed, given that NNPC controls Nigeria's oil revenue, its recognition by the President strengthens its role as a referee and a player (NGN19). DPR may not see DCC as a co-regulator or in charge of the environmental aspect of the problem. In response to an interview question, "how do you work with DCC?" One interviewee said, "the DCC has not transgressed or trespassed into the oil and gas governance. They (DCC) request information and cannot issue directives" (NGN7).

A lack of cross-coordinated coordination was also an emerging barrier. It has manifested in at least three aspects. It is a manifested barrier because the number of regulators governing gas makes it difficult to know the substantive regulators. One group of interviewees suggested that it starts with sectoral parallel working, which crystalises into a problem at the national level (NGN12-13).

There seems to be a chasm between the MoE/DCC and DPR in implementing the gas flare-out programme (NGN1). One view is that DPR is territorial, which makes cross-cutting coordination difficult (NGN3-6). Whatever the case, co-regulators (DCC and DPR) are not collaborating to tackle flaring (NGN16-18). It seems gas governance coordination is not happening at the ministerial or

national level, and MoE is poorly resourced compared to MPR. However, the reality could be that cross-cutting coordination can be complex due to the politics of hydrocarbon. It seems it may not just be a case of DCC not being willing to collaborate but also a lack of enabling environment.

5.4.3.3   Barrier #10 lack of capability and uncoordinated international support

An emerging barrier was a potential lack of capability by DPR and DCC as co-regulators. To explore this potential barrier, I asked an interview question, "on a scale of 1-10, how would you rate DPR/DCC and their integration with one another?" This probe led to the result that both DPR and DCC as co-regulators have a low capability rating and weakly integrated gas governance.

Twelve interviewees scored DPR an average of four out of a possible ten as a co-regulator. A group of interviewees felt DPR could do more:

 "DPR is as an average performing regulator, because of the commercialisation programme" (NGN1), but "there is hardly any interface with DCC on the climate angle" (NGN3-6).

Another group of interviewees supported each other's views that:

"There could be a better exchange of knowledge between DPR and DCC" (NGN8). "A lot more could be done by DPR about climate change" (NGN11).

A third group were less complimentary and said:

"DPR has a distorted sense of its role" (NGN9), and "there is little exchange of information between DPR and DCC (NGN16-18).

Twelve interviewees also rated DCC an average of two out of a possible ten as a co-regulator. The views of DCC's capability were less complimentary than that of DPR. They included:

"It (DCC) is hugely ineffective, absent, uninterested, and uninvolved. It has shirked its responsibility, on flaring" (NGN1). "There is little to no awareness of what they do" (NGN3-6). "There is hardly any visibility from DCC" (NGN8).

Another perspective also included:

"The Minister of Environment complains that MOE/DCC are left out of key discussions, and DCC has little to no activity on flaring" (NGN10).

Perhaps a more worrying view was from two interviewees who said:

"DCC does not seem to have any footprint in the Niger Delta" (NGN13-16), and "I do not know what DCC does" (NGN1).

The lack of capability also manifested in regulators' focusing on price instead of process and getting the prices wrong. For example, one interviewee said:

"I would be nervous as an investor to invest with a regulator that focuses on price. However, I would be more nervous if they focused on price and lack the knowledge to build effective economic models" (NGN2).

Another interviewee said,

"Nigeria's gas sector management is left in the hands of a Ministry that did not have the capability. Therefore, each Minister brought in their teams, and when they left, it led to a loss of institutional memory" (NGN1).

Without capability and low performance on integrated working, it is no surprise that there is little to no cross-cutting coordination. As shown in emerging barrier #9 (lack of systems thinking)**,** twelve partners supplied support to build capability. However, a lack of collaboration from the global results has manifested at the Nigerian level. As one of my interviewees said, "there are gaps in articulating and coordinating climate change opportunities as projects" (NGN9).

5.5   Significant barriers-root origins for global and Nigerian associated gas flare governance

In what follows, I use two matrices, each for the global and Nigerian level of analysis, to simplify the network diagrams (**Figure 5-3** and **Figure 5-9**) and determine the significant manifested barriers and root origins.

5.5.1 Significant barriers and root origins for the global level

Research objective 5: to determine the significant barriers and their root origins at the (a) global level: Another result of the analysis is that seven of the eight manifested barriers at the global level are significant to the systematisation of associated gas flare governance. Weak knowledge management also displays eight connections, and a targeted approach could work in prioritising and sequencing the policy solutions. Furthermore, three of the five origins are root origins which means a systems view of the barrier could lead to better solutions. A clustered approach to policy solutions targeted at the significant barriers and root origins could be more effective

5.5.1.1 Significant barriers for the global level

Table 5-5 shows that at the global level, seven of the eight manifested barriers are significant but with different rankings. I defined significant manifested barriers as those connected to at least four other barriers or influences. The total number of connections is the sum of columns *3-4*.

For example, a lack of horizon scanning, awareness, and engagement (#1) and weak knowledge management (#3) was ranked first with a total of eight connections. This barrier means there are missed opportunities to collaborate, and it can be traced to the origin of the politics of sponsors. It goes with a lack of specialisation and overlapping goals to explain the lack of goal coherence. However, manifested barrier #1 also intensifies the effect of incomplete and inconsistent norms and standards – an influence on lack of effective instruments.

Table 5-5 Significance and ranking of manifested barriers at the global level

	Barriers	Number Of		Total number of connections, significance and ranking	
		Barriers to barriers connections	*Barriers to influences connections*	*Total number of connections*	*Rank*
Lack of goal coherence	#1 Lack of horizon scanning, awareness, and engagement	3	5	8	1st
	#2 Lack of specialisation and overlapping goals	1	3	4	4th
Lack of effective instruments	#3 Weak knowledge management	4	4	8	1st
	#4 Lack of market instruments and financing	2	2	4	4th
	#5 Incomplete/inconsistent norms and standards	2	3	4	4th
Lack of efficient processes	#6 Lack of horizonal collaboration	3	4	7	2nd
	#7 Duplication of activities and passive acceptance	2	3	5	3rd
	#8 Few flare-out projects, lack of progress and degrees of frustration	0	3	3	5th
Legend					
	Significant barrier with 4 or > 4 total connections				

Source: Author

Weak knowledge management also displays eight connections. However, it could be prioritised and tackled to deliver the most effective solution for three reasons. While it originates from a sense of proprietary knowledge (origin # 2), it links to origin #1, the politics of sponsors. Apart from a failure to fully deploy the knowledge management process, this manifested barrier affects two others: lack of effective instruments, lack of marketability and financing instruments (#4), and incomplete and inconsistent norms and standards (#5).

The five global initiatives have not created market matured instruments but may have access to development finance. However, the same initiatives are not sharing existing knowledge and using this to guide behaviours as norms, which stems from a lack of willingness to fully adopt the four knowledge management processes. Notably, a weak knowledge management process influences a lack of effective knowledge, market, and normative instruments (within its category). It also affects a lack of

mutual sense of direction (lack of goal coherence). Besides, in the efficient processes category, weak knowledge management influences a lack of collaboration.

A weak KM process also affects two manifested barriers in the lack of efficient process category: #6 lack of horizontal collaboration and #7 duplication of activities. By not collaborating horizontally through full adoption of the KM process effectively, the initiatives duplicate each other's activities and potentially contribute to inconsistencies. For example, to "change norms and behaviour and set up new standards". The standard setting is knowledge creation and dissemination activity; to effectively set standards, the initiatives require better knowledge platforms and networks than they currently have.

Each of the five global initiatives looks to change country policy frameworks and heavily rely on their research investment for insights. However, they need to share knowledge better to effect changes in policy frameworks. Moreover, sharing knowledge consists of communicating it beyond the boundaries of the organisation where it originates. While the barriers in the lack of effective instruments category are critical, the weak KM also seems to be a significant barrier. However, it could be more accessible to address than the politics of sponsors.

A lack of horizontal collaboration leads to duplication of activities. It also means few flare-out projects: over 16,000 flare sites globally (manifested barrier #8). Notably, duplication of activities could be a contributory factor. While potentially affecting goal coherence, both these barriers drive a lack of mutual sense of direction (influences). However, they also contribute to a lack of progress and degrees of frustration felt by insider stakeholders (manifested barrier #8). Perhaps another concern is that both these barriers also affect three influences, leading to a lack of efficient processes. As captured by one of my interviewees:

"While there are 16,000 flare sites globally, and we need scalable business models to tackle the problem. The five global initiatives are duplicating activities, circling the policy drain, and hardly having real-life direct implementation projects" (INT2).

Notably, horizon scanning, awareness, engagement, and the fourth knowledge management (sharing knowledge) lead to inter-initiative relationships. A lack of sharing knowledge could explain multiple barriers because the initiatives are not working together. In addition, it seems a few flare-out projects, the lack of progress and degrees of frustration are an outcome of the other seven barriers. The ranking

of the barriers by significance could enable the initiatives to prioritise the targeted policy solutions. Manifested barriers #1 and #3 should be prioritised as the most impactful problems to be tackled.

5.5.1.2 Root origins for barriers at the global level

Table 5-6 shows that three of five origins are root origins that create barriers for global associated gas flare governance. As highlighted earlier, the politics of sponsors is one of the root origins. It accounts for four connections to other origins and barriers. The result aligns with the significant barriers. The first to the third-ranked barriers originate from the three root origins. The results show policy solutions targeted at the manifested barriers #2, #3, #6 and #7 could also address origins #1, #2 and #5.

A clustered approach to policy solutions targeted at the significant barriers and root origins could be more effective as shown in **Chapter 6**.

A lack of horizon scanning (origin #1) is linked to sponsors' politics and contributes to weak knowledge management processes. Furthermore, barrier #5 (incomplete and inconsistent norms and standards) is traced to weak knowledge management and shows how a solution that enhances sharing knowledge contributes to addressing it. Adopting better KM processes could enhance horizon scanning without looking to change sponsors' politics. This approach shows that horizontal collaboration could start addressing the significant barriers and root origins.

Table 5-6 Root origins and ranking at the global level

	Origins	Indicators of root cause based on relationships to:		Total number of connections, significance and rank	
		Origins to origins connections	Origins to barriers connections	Total number of connections	Rank
Lack of goal coherence	#1 Politics of sponsors	2	2	4	1st
Lack of effective instruments	#2 Sense of propriety	1	3	4	1st
	#3 Transition from Kyoto Protocol to Paris Agreement	0	2	2	4th
	#4 Lack of political authority or legitimacy	0	1	1	
Lack of efficient processes	#5 Lack of systems thinking	1	3	4	1st
Legend					
Root origin with 4 or > 4 connections					

Source: Author

5.5.2   Significant barriers and root origins for the Nigerian level

Research objective 5: to determine the significant barriers and their root origins at the (a) global level: At the Nigerian level, the result of the analysis shows that all the twelve manifested barriers are significant based on the rule I set of at least four connections to other barriers and influences. What is interesting for the Nigerian analysis is that a systems approach could mitigate some of the significant barriers and the global initiatives have a key role to play in making this happen. For the origins of the barriers, all six are root origins. Given the 60-year institutionalisation of associated gas flare governance in Nigeria, this finding is hardly surprising. However, it means a clustered approach and committed effort would be required in designing and implementing solutions which also must be prioritised and sequenced.

5.5.2.1 Significant barriers for the Nigerian level

Table 5-7 shows that all the ten manifested barriers are significant with varying ranking. Not surprisingly, the lack of enabling legislation ranked first with nine connections. For example, it leads to a lack of clarity in the rights of gas investors, a lack of a clear commercial identity (manifested barrier #1) and a lack of infrastructure investments (manifested barrier #5).

Indeed, it is challenging to develop unified associated gas governance goals without primary legislation, which is the prerequisite quality of good governance[18]. Furthermore, this barrier means it is also challenging to implement the plans for a single, independent regulator and clarify associated gas governance processes (manifested barrier #9).

A lack of accurate data and fragmented MRV development ranked second. According to one group of interviewees, the MoE collaborated with an international NGO, Stakeholder Democracy Network. Together, they created NOSDRA to track associated gas flare and generate reliable data[19] (NGN13-16). However, instead of using a government-owned data source, another interviewee said that:

"DPR who request that oil companies bring their associated gas flare data, which they (DPR) try to reconcile when they do not have the capability needed" (NGN10).

The success of the associated gas flare commercialisation programme relies on correct flare data. The lack of data and fragmented MRV development means inaccurate flared gas data. It is challenging to assign market values and identity to associated gas affecting manifested barriers #1 and 5. Furthermore, the barrier supports the view of a breakdown in governance processes displaying a failure to work together by two government departments (Ministry of Environment and Ministry of Petroleum Resources). In addition, it is also another way of strengthening the case that a lack of regulatory clarity and cross-cutting coordination is a barrier. Finally, it reinforces the possibility that a barrier of lack of horizontal coordination exists at the Nigerian level.

As highlighted earlier, a dysfunctional incentivisation and lack of clear identity for associated gas is affected by all the origins and barriers and ranked third. This barrier means investors are not motivated to invest in sectors with potentially more significant impact. However, the divestment from fossil fuel and lack of climate finance also increases this barrier. The fourth-ranked manifested barrier, a mismatched political/investment cycle, is a global problem in democratic governments. There are no solutions to mitigate the impact of short political cycles apart from greater transparency enhanced by media, scrutiny and accountability.

---

[18] NRGI, *Natural Resource Charter [Online] 2nd ed*. (Natural Resources Governance Institute, 2014): p. 8, https://resourcegovernance.org/approach/natural-resource-charter#:

[19] "Nigerian Gas Flare Tracker," NOSDRA, accessed 10 May 2021, https://nosdra.gasflaretracker.ng.

Table 5-7 Significance and ranking of manifested barriers at the Nigerian level

	Barriers	Number Of		Total number of connections, significance and ranking	
		Barriers to barriers connections	*Barriers to influences connections*	*Total number of connections*	*Rank*
Lack of goal coherence	#1 Dysfunctional incentivisation and unclear identity for gas	3	4	7	3rd
	#2 Mismatched political/investment cycles	2	4	6	4th
	#3 Lack of or inaccurate data and fragmented MRV development	3	5	8	2nd
Lack of effective instruments	#4 Lack of climate mitigation financing	2	2	4	6th
	#5 High counterparty risk and lack of infrastructure investment	2	3	5	5th
	#6 Lack of commercial frameworks and sanctity of guarantees	2	3	5	5th
	#7 Lack of enabling legislation	5	4	9	1st
Lack of efficient processes	#8 Breakdown in governance process	3	2	5	5th
	#9 Lack of regulatory clarity and cross cutting coordination	3	3	5	5th
	#10 lack of capability and uncoordinated international support	3	3	5	5th
Legend					
Barriers-barriers and barriers-influences connections and significant barriers					

Source: Author

It is worth noting five insights on the connectivity and importance of the fifth-ranked barriers. Each of them is somewhat persistent and needs to be tackled. First, manifested barrier #5 has two parts. High counterparty risk is linked to Nigeria's electricity sector, close-to-bankruptcy, but it is a significant gas consumer. Based on the above, the focus of regulation could be on enabling investment. However, the private sector investors need to know that Nigeria has credible infrastructure plans or can reward them for taking a risk (NGN1).

Second, while it is essential to develop relevant commercial frameworks for associated gas (manifested barrier #6), addressing the lack of sanctity of agreements is critical. As an interviewee said:

 "What potential investors in the associated gas flare commercialisation programme ended up getting was not what was promised, nor, nearly within the same period. It has taken longer to complete the procurement, and potential profits have become smaller (NGN2).

According to this interviewee, the programme procurement qualification process was like being asked to run an 800-metre race:

 "You get to the end, and the officials (DPR) tell you to keep running, but do not tell you how many more laps before winners are decided" **(**NGN19**).**

Third, there is a breakdown in the governance process. This breakdown led the then Minister of State for Petroleum to write to the President, alleging "insubordination and corruption by the Group Managing Director of the NNPC"[20].

Three interviewees supported the allegation of insubordination by saying:

 "NNPC avoids due process, and this leads to a lack of investor trust" (NGN3-6).

It seems NNPC has more credible relationships with the President, who is the substantive Minister of Petroleum, than the Minister of State. According to the interviewees, "the Minister of State is not really in charge" (NGN10 and NGN19). This barrier is not surprising given Nigeria's revenue is tied to crude oil, which NNPC controls. However, it points to significant barriers in achieving gas governance goals without Presidential interventions.

Fourth, the lack of regulatory clarity and cross-cutting coordination means associated gas would continue to struggle for a commercial and climate change identity. Inter-ministerial collaboration is missing, and DPR seems to have a distorted view of its role (NGN11). Furthermore, while MoE/DCC

---

[20] Ogundipe, 2017.

may be the weakest link, Nigeria's associated gas-related climate action is not being led by the Department of Climate Change. One interviewee captured it best by saying:

"Ending flaring cannot be done right if the environmental conversations are not led by the environmental agency" (NGN2).

The preceding shows that DCC is not recognised as the environmental expert in the fragmented associated gas flare governance space.

Fifth, a lack of capability might seem to be a mild barrier. However, it cuts across all aspects of the barriers to coherent goals, effective instruments and most importantly, it is a cornerstone of efficient processes. Without capable civil servants, Nigerians would struggle to implement efficient processes for effective governance of associated gas flaring.

5.5.2.2 Root origins for barriers at the Nigerian level

Table 5-8 shows the six origins are root origins for the Nigerian level barriers. Unlike the global level results, the root origins results do not closely align with the significant barriers.

For example, the 20-year delay in passing the PIB (origin #5) is a root origin and ranked third. However, a lack of enabling legislation (manifested barrier #7), which stemmed from this origin, was ranked first among the significant barriers. While a lack of gas-specific legislation is ranked third, its impact is cross-cutting. It limits the practical implementation of the targeted policy solutions, as shown in **section 6.4.2**. A clustered approach may work in implementing policy solutions. Furthermore, as shown in the next section, there are no existing solutions for the 20-year delay in passing the PIB, only views on the realities.

Table 5-8 Root origins and ranking at the Nigerian level

	Origins	Indicators of root cause based on relationships to:		Total number of connections, significance and rank	
		Origins to origins connections	Origins to barriers connections	Total number of connections	Rank
Lack of goal coherence	#1 Politics of hydrocarbon	3	4	7	3rd
Lack of effective instruments	#2 60-year evolution of institutions of governance	2	6	8	2nd
	#3 Nature of donor funding	1	4	5	4th
	#4 Subsidies and non-viable downstream market	1	3	4	5th
	#5 20-year delay in passing the PIB	1	6	7	3rd
Lack of efficient processes	#6 Lack of systems thinking	3	6	9	1st
Legend					
	Root origin with 4 or > 4 connections				

Source: Author

5.5.3   The viability of the global and Nigerian associated gas flare systems

Research objective 6: to assess the viability of the global and Nigerian associated gas flare governance systems based on the manifested barriers and origins: Overall, the findings in this chapter point to global and Nigerian associated gas flare systems constrained by the significant barriers and root origins, individually and as an entity. See **Figure 5-16**Error! Reference source not found..

Arguably, only the root origins and significant barriers should be presented to show the constraints on the system. However, only a few barriers were insignificant insights and the origins that were not root origins play a key role in better governance if they are mitigated. There is a need to be further validate the findings with my elite interviewees at both levels of abstractions. For now, the findings are unpacked once again at the global and Nigerian levels to show a lack of minimum viability.

Figure 5-15 Global and Nigerian associated gas flare governance origins, barriers and influences
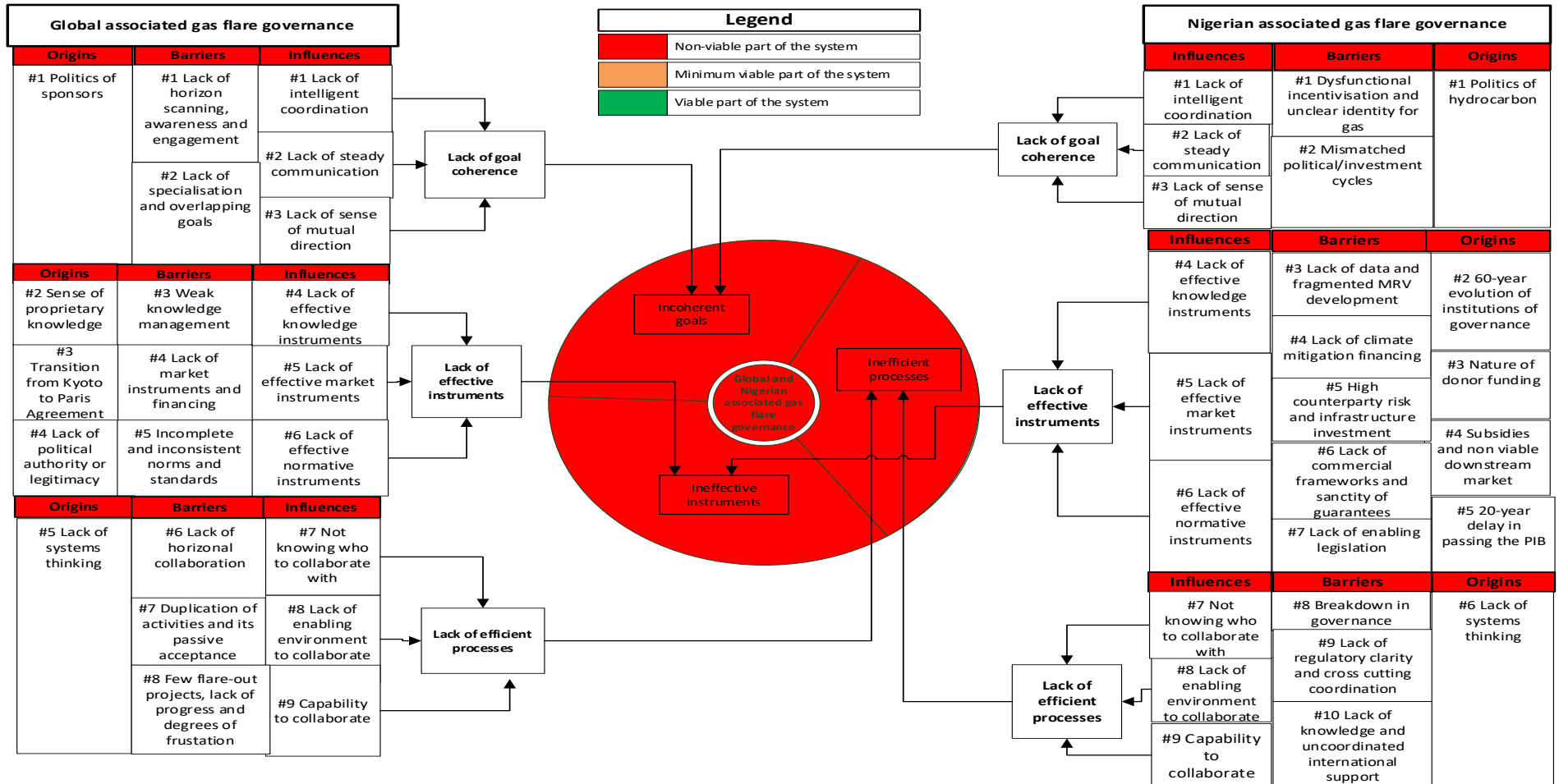
Source: Author

5.5.3.1 Constraints for the global level

Figure 5-16 Error! Reference source not found. shows how the barriers and origins constrain the global associated gas flare governance system. The overall results show that the system does not display the minimum viability needed for effective governance due to barriers that negatively influence the goals, instruments and processes. For example, sponsors' politics manifested as an origin with two barriers, leading to a lack of intelligent coordination, steady communication and sense of mutual direction, and ultimately a lack of goal coherence.

In addition, three origins create three barriers that influence a lack of effective knowledge, market and normative instruments, and ultimately a lack of effective instruments. Likewise, a lack of systems thinking is an origin that creates three barriers, affecting three influences of a lack of efficient processes. As highlighted earlier, the eight barriers collectively influence a lack of goal coherence, effective instruments and processes. However, prioritising and dealing with the politics of sponsors could shift the system towards minimum viability, as seen in **section 6.4.**
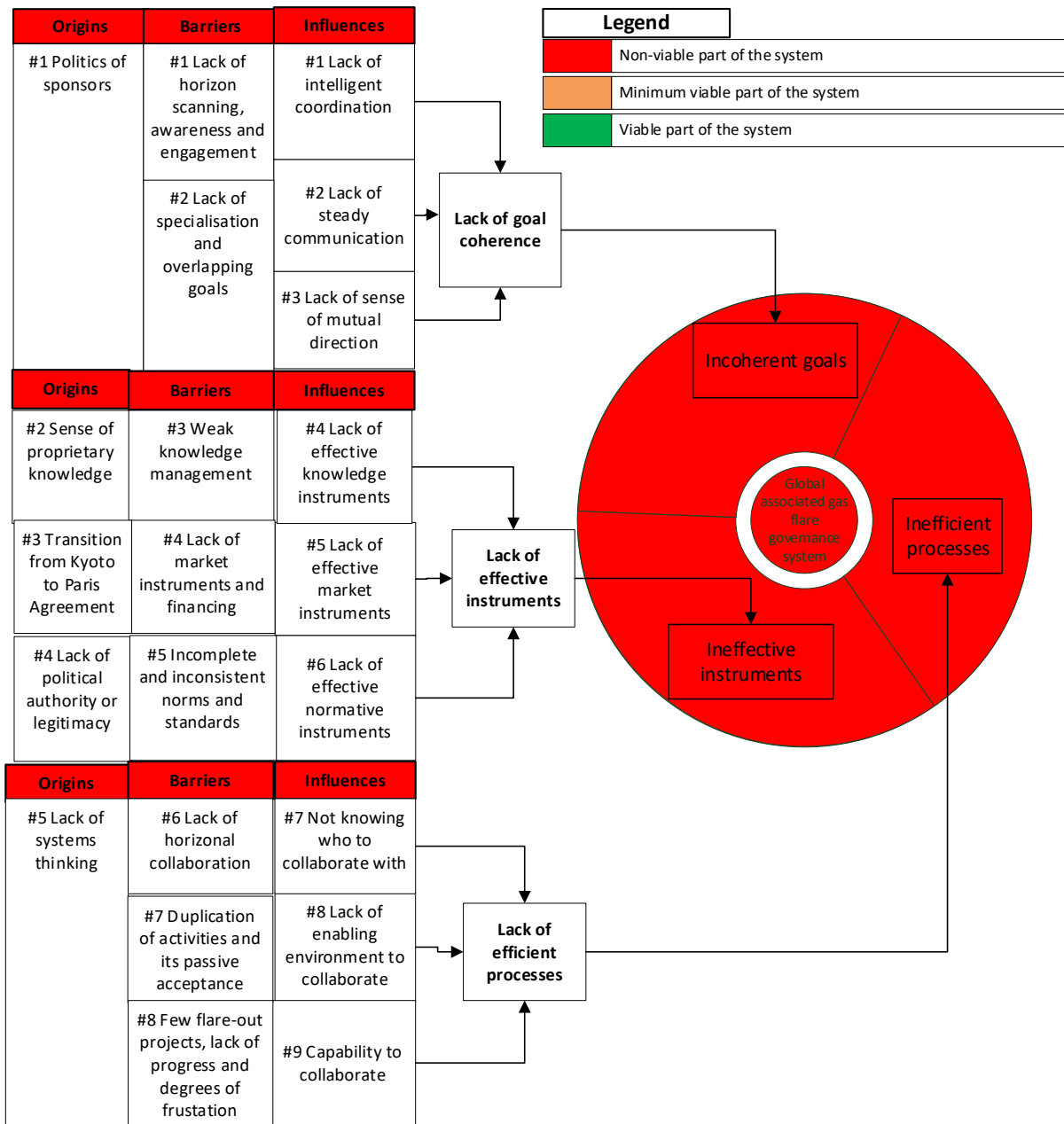
Figure 5-16 Global gas governance: origins, barriers and influences

Source: Author

5.5.3.2   Constraints for the Nigerian level

Figure 5-17 Error! Reference source not found. shows that the Nigerian associated gas flare governance system lacks the needed minimum viability, like the global level. However, while politics is an origin for both abstraction levels, hydrocarbon-based economy and politics lead to dysfunctional incentivisation and a lack of clear identity for gas. Furthermore, while a mismatch between political

and investment cycles is a global phenomenon, it is more intense in Nigeria. The first two barriers lead to goal incoherence.

Another difference between both levels is that the Nigerian level manifested more instrument-related barriers originating from at least four sources. Four barriers, including donors' divestment from fossil fuel, subsidies and non-viable downstream market and a lack of gas-specific legislation, means ineffective instruments. Furthermore, like the global level, a lack of systems thinking creates three barriers. It leads to three influences meaning a lack of efficient processes. The prioritisation and sequencing of the targeted policy solutions could shift the system towards minimum viability.
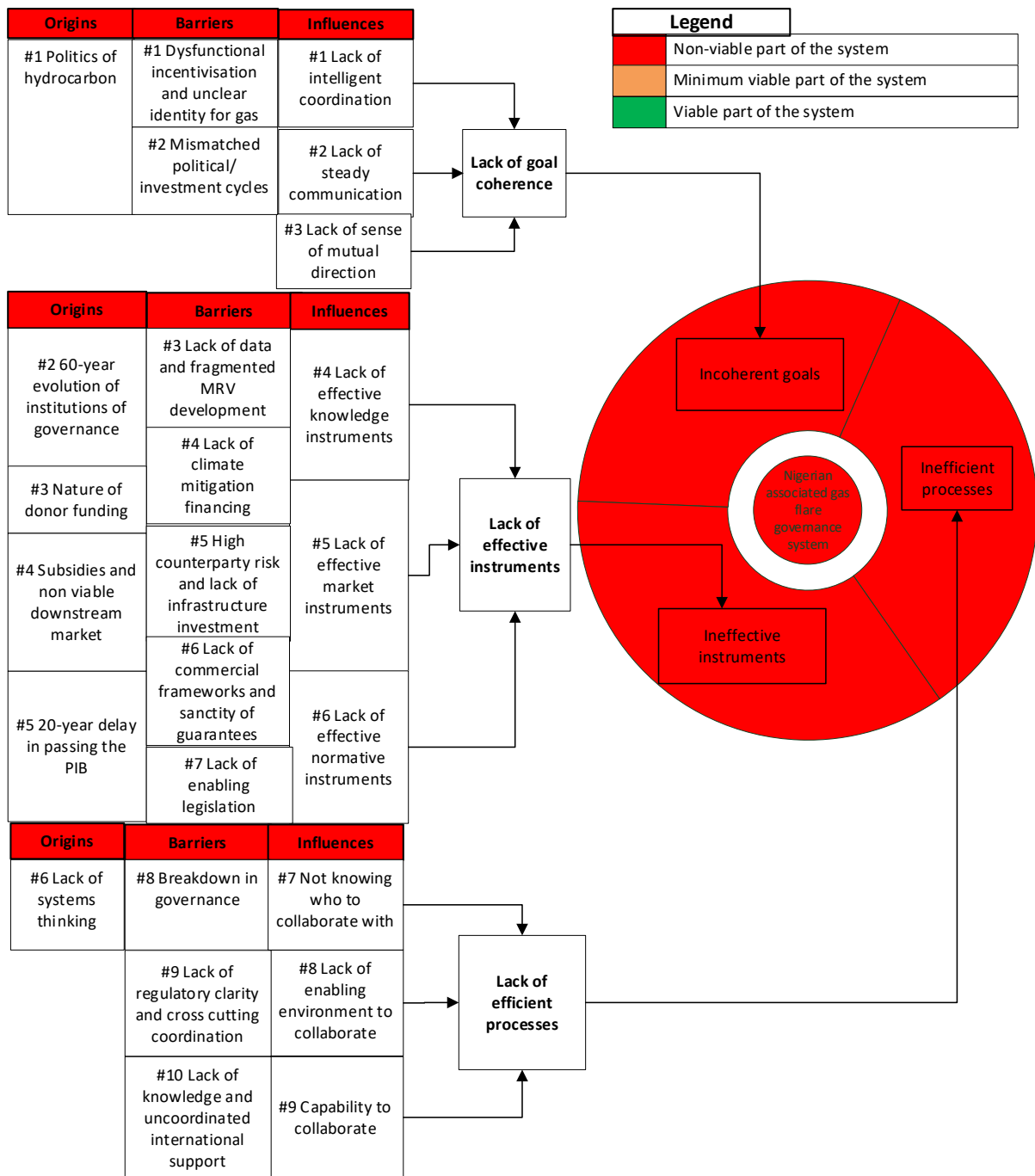
Figure 5-17 Nigerian gas governance: origins, barriers and influences

Source: Author

5.6   Summary of chapter five

This chapter has analysed and evaluated the emerging global and Nigerian associated gas flare governance system and found it highly constrained and undermined at both abstraction levels. Both

abstraction levels show a lack of coherence. They originate from the politics of sponsors (global) and the politics of hydrocarbon (Nigerian). A lack of effective instruments is also evidenced at both abstraction levels, but their origins are markedly different. While the barriers to efficient processes at the global level seem to be a plain lack of working together, Nigeria's barriers may have deeper undertones.

The next chapter presents solutions suggested by the elite interviewees and how they could be prioritised, sequenced and targeted at the barriers. An evaluation of the system follows this to again, decide its minimum viability.

Chapter 6 Policy solutions for global and Nigerian associated gas flare governance

6.1 Introduction to chapter six

This chapter answers my third research question: what are the policy solutions for the barriers and origins to the systematised global and Nigerian associated gas flare governance? The chapter completes the systemisation, of the global and Nigerian gas governance based on the emerging barriers (**Chapter 4**)-manifested barriers-origins (**Chapter 5**) -solutions (**Chapter 6**) approach. I operationalised the question by devising the solutions and gauging how they could tackle the manifested barriers (and origins) from **Chapter 5** around three research objectives.

Section 6.2 and **6.3** meets my seventh objective "to devise solutions to the manifested barriers and origins for the systematised (a) global and (b) Nigerian associated gas flare governance.". **Section 6.4** meets my eight objective "to determine the sequencing and prioritisation of the policy solutions for the systematised (a) global and (b) Nigerian associated gas flare governance". **Section 6.5** meets my ninth objective "to assess the viability of the systematised global and Nigerian associated gas flare governance after application of policy solutions". Finally, I supply the chapter summary in **section 6.6**.

6.2 Policy solutions for barriers and origins at the global level

Research objective seven: to devise solutions to the manifested barriers and origins for the systematised (a) global associated gas flare governance: Table 6-1 captures the seven devised policy solutions for the global level. The solutions are categorised by my interviewees to show the diversity of sources. Each solution, apart from #2, directly targets two manifested barriers and in some instances the origins. I present the solutions considering their impact on significant barriers and root origins. Each of the seven policy solutions are described in what follows.

Table 6-1 Policy solutions for the global level

Policy solutions by interviewees	Targeted manifested barriers and rankings							
	1st	4th	1st	4th	4th	2nd	3rd	5th
	#1 Lack of horizon scanning, awareness and engagement	#2 Lack of specialisation and overlapping goals	#3 Weak knowledge management	#4 Lack of market instruments and financing	#5 Incomplete/inconsistent norms and standards	#6 Lack of horizonal collaboration	#7 Duplication of activities and passive acceptance	#8 Few flare-out projects, lack of progress f
#1: Better horizon scanning and orchestration *(GINT1, GINT2, GINT4, GINT5, GINT7 & GINT8)*	🟩		🟩				🟩	
#2: Applying broad church approach for specialisation and broad goals *(GINT1, GINT2, GINT3, GINT4 & GINT7)*		🟩						
#3: Meeting regularly to create joint programme of activities[1] *(GINT1, GINT2, GINT7 & GINT8)*	🟩	🟩	🟩			🟩	🟩	
#4: Better application of KM to develop market instruments, and consistent standards *(GINT1 & GINT2, GINT2 & GINT5)*			🟩	🟩	🟩	🟩		
#5: Application of real options to improve ZRF and global adoption *(GINT1, GINT2 & GINT4)*				🟩	🟩			
#6: Better use of climate risk to collaboratively advocate to increase # of projects *(GINT2, GINT3, GINT4, GINT5 & GINT6)*				🟩		🟩		🟩
#7: Constant monitoring and evaluation of progress against goals *(GINT1 & GINT2)*								
🟩 The solution targets the highlighted and cross-referenced barrier								

Source: Author

Note: *Solution #1 also addresses origin (#5), the lack of systems thinking, ranked as the 2nd root origin. Through*

KM and policy solutions #1, #2 and #3, the initiatives develop political authority and legitimacy, so policy solution

#4 also starts to address origin #4 (ranked as a 3rd root origin but clearly origin # 2, ranked as a 2nd root origin. By working together, sharing knowledge, application of real options to enhance ZRF principles and to create norms, the initiatives develop legitimacy and some political power for implementability at national levels.

6.2.1 Policy solution #1 Better horizon scanning and orchestration

This first policy solution tackles the first ranked barrier of lack of horizon scanning, awareness and engagement (#1) and others. It could also tackle another first ranked barrier (weak knowledge management (#3)) and duplication of activities (#7 ranked third). Policy solution #1 could also address a lack of systems thinking which is a root origin. According to an interviewee, this is the most basic solution which addresses a fundamental barrier of lack of awareness and engagement (GINT1). According to another interviewee, it directly tackles a lack of systems thinking (GINT8).

Furthermore, the estimated $100 billion investment needed to end global flaring might be significant, but it could be partially secured through the demonstrable leadership that arises from better horizon scanning and orchestration. The five initiatives could achieve better results if they know what other initiatives are doing and use their convening authorities in a more targeted manner. An interviewee said:

"It could start with feasibility analysis. This analysis could include how to raise the $100 billion (or more) investment that is needed" (GINT7).

Another interviewee suggested, "using scalable business models" (GINT2).

While the politics of sponsors may be a root origin, one of the interviewees was optimistic about tackling it and suggested:

 "Although sponsors want different things, there are middle grounds, where regular meetings and horizon scanning could lead to better results while meeting the special requirements of sponsors" (GINT7).

Indeed, the initiatives could become more aware of each other, engage in better knowledge management, collaborate better and reduce duplication of activities; through better horizon scanning. However, the suggested "middle ground" is a slippery slope towards a lack of specialised goals which is a barrier itself.

Notwithstanding, global climate initiatives backed by the World Bank's GGFR and ZRF and UNFCCC or other large global organisations such as OGCI have a central role in showing demonstrable leadership through orchestration as a partial solution. According to one interviewee, the leading initiatives could achieve more by bringing all the decision-makers of the initiatives around one table. Such events could happen every year or twice a year (GINT9).

Indeed, a simple solution such as meeting more regularly could help. For example, the GGFR and UNFCCC team met last in 2010, citing travelling challenges; hopefully, this could change with the new virtual working norms due to COVID-19. Another interviewee suggested that the GGFR, ZRF2030 and UNFCCC AM0009 could act as the primary conveners. These three initiatives could bring together initiatives focusing on reducing flaring, sharing experiences, and increasing the active initiatives, directly tackling flaring (GINT4).

Connecting resources through orchestration allows for more coherent goals. As confirmed by three interviewees, this policy solution is possible and needed. For example, two interviewees said it was possible. According to them, the World Bank's GGFR and ZRF, and UNFCCC "are the only genuinely inclusive sponsors with members who can implement the scale of horizontal collaboration needed" (GINT7 and GINT8). However, another interviewee said, "it would take a joint effort by World Bank, and UNFCCC.

A joint effort is needed to implement this solution which does not slow the pace of delivery. Nevertheless, moving at the pace to the slowest 'ship in convoy' is a genuine concern for achieving collective progress" (GINT5).

6.2.2   Policy solution #2: Applying a broad-church approach

According to an interviewee, the initiatives could draw from the strength of their sponsors to make this solution work (GINT7). It seems to tackle the significant barrier of lack of specialisation and overlapping goals ranked fourth. In addition, it could also address a lack of systems thinking which is a root origin. This approach means accepting that different coalitions exist. However, it could create a broad church of denominated specialisations. This broad church could tackle different flare-out aspects, increase gas use, and connect the dots through systems thinking.

This solution works by allowing coalitions of interest but denominations within broader groups as a pragmatic approach. There are four routes to its implementation.

First, the UNFCCC's and World Bank's global convening authority could allow broader but specialised denominations. The UNFCCC has the backing of 196 member countries. An interviewee suggested UNFCCC could revamp the CDM method number AM0009 to increase access to climate finance for flare-out projects linked to NDCs of developing countries (GINT7).

Second, according to two interviewees, the World Bank sponsors GGFR and ZRF 2030 and they could better use the convening authority of their development arms more effectively to support Nigeria's gas commercialisation through the CDM AM0009 (GINT1 and GINT2). For example, Nigeria has hundreds of flare sites and an ambitious gas linked NDC. It wants to commercialise its gas, but as seen in **section 4.5.2**, but is struggling to attract climate finance. While GGFR, USAID and Power Africa are helping to implement a solution for Nigeria to commercialise its gas, a key barrier is the lack of climate financing.

Third, another interviewee suggested OGCI could do more to corral oil companies to commit to ending flaring on its platform rather than individually in potentially disparate ways (GINT2). According to three other interviewees, OGCI could use its convening authority on its 13 oil and gas members to increase the focus on flare reduction (GINT2, GINT3 and GINT4). Indeed, this approach could help OGCI specifically target flaring while focusing on CCUS and methane to meet their members' expectations.

Fourth, the first global level solution of horizon scanning, and orchestration could include bringing in commercial solutions implementers around the table, a solution working in Oman. According to an interviewee, this could include Flare-2-Value (GINT2). In addition, broad-church standards Initiatives like Climate Disclosure Standards Board could help develop more integrated goals aligned with more explicit leadership, capturing and exporting best practices (GINT2).

6.2.3 Policy solution #3: Meeting more often and creating joint programme of activities

This solution starts with bi-annual meetings, where the leading global initiatives could create joint programme of activities as outcomes. It tackles five significant barriers, two of which are ranked first. It starts with actors with similar goals, meeting regularly, and creating more joined-up programme of activities and better horizontal coordination.

According to an interviewee, umbrella bodies like the World Bank need to bring all initiatives around the table. Such a meeting could be once or twice a year to see if there are somehow overlaps and new

business that could be formed (GINT7). This solution could also lead to better resource use through collaboration, effective financing and more projects.

However, no single organisation can tackle the problem because it is multifaceted and requires joining the dots while working collaboratively. The World Bank has access to finance. So does OGCI, in addition to its member companies. The UNFCCC could lead on this solution to tackle flaring partnering with the other four initiatives and work better with country partners. Apart from being a usual barrier, the lack of effective collaboration might be less complex to tackle for the global associated gas flare governance initiatives. They are still at a formative stage.

According to another interviewee, the GGFR, UNFCCC and OGCI as conveners should include the relevant high associated gas flaring countries in cross-initiative dialogue and collective outcomes (GINT2). Another interviewee suggested that the initiatives could link the meetings to creating market opportunities and other solutions like sharing knowledge and joint work programmes (GINT1). Notably, the UNFCCC is the only initiative that receives its mandate from 196 parties as country members. Through its members, the UNFCCC could better engage with 196 countries. According to two interviewees, such engagements are ongoing as part of the development of NDCs (GINT7 and GINT8).

6.2.4   Policy solution #4 Better application of knowledge management

There are two parts to this solution: (1) the specialist initiatives to develop market instruments and norms and share this and (2) better use of knowledge-sharing platforms for deeper dissemination.

Specialist initiatives to develop market and normative instruments

First, when it comes to flaring, having a group of initiatives like the World Bank's GGFR defining how to measure the flare quantity going to the flare is essential. The suggested improvements in measurement come with problematic technical specifications, such as estimating the remaining gas going to the flare or best practices to figure out the gas flared.

According to an interviewee (GINT5), World Bank and UNFCCC could develop the norms as independent authorities. However, both initiatives could collaborate with the private sector oil companies, which can directly supply the information from the flare sites.

Better use of knowledge sharing platforms for deeper dissemination

There could be another layer like the OGCI, taking the norms, standards and definitions and applying them across its members and setting targets. Through this layered approach, it would be possible to build the knowledge-based governance, mixed with markets to maturity, and then progress to using the norms. Another interviewee supported this approach by saying:

"By applying better knowledge management to develop market instruments and consistent standards, joint projects can be created. These projects could give the right signals to the market, as shared investments, research, and risk" (GINT2).

The ineffective deployment of knowledge management is a crucial barrier to consistency in norms and standards. According to one interviewee (GINT2), the initiatives could consider two options for improving knowledge management across global associated gas flare governance initiatives.

The first option is one with no significant investment but just a knowledge-sharing platform coordinated by one of the leading initiative's secretariats. The second option acknowledges that flare reduction is a new industry. This new industry requires capabilities. Therefore, the initiatives could make a significant investment to create an innovative sharing platform to find critical intervention opportunities, learn lessons and replicate scalable business models.

6.2.5   Policy solution #5: Application of real options principles

This policy solution targets a lack of market and normative instruments, which also arises from uncertainties of not knowing the available quantity of associated gas before the actual exploration of oil. According to another interviewee, a vital challenge of the ZRF 2030 principles is using a flawed, real options analysis to enforce good behaviour by the oil and gas companies in utilising associated gas (GINT1).

Countries agree contracts with oil companies before oil exploration, which could lead to the discovery of commercially viable associated gas. According to two interviewees, ZRF's binary view of countries insisting on (a) "what to do with associated gas" before issuing the exploratory licence or (b) "agreeing on what to do with associated gas in legacy fields" is a weak attempt at addressing the challenge posed by the above uncertainty (GINT1 and GINT2).

This uncertainty requires an element of guesswork initially but could be tackled with contingencies and options. Building real options into the principles enables a more flexible estimation of values and

deals with a flawed assumption that investors must make investment decisions now or never. Once made, it cannot be changed to capture new underlying assets. According to an interviewee, "such an application and rationale by ZRF and GGFR could lead to better valuation of associated gas and could be treated as a 3rd principle of ZRF, contingent associated gas discovery and valuation" (GINT1).

An interviewee also suggested a global adoption of the ZRF 2030 principles in oil exploration (GINT4), progressing beyond the current endorsement by companies, development organisations and countries. In this existing solution, there should be agreement on what to do with associated gas. This agreement could be before granting a licence. In addition, there must be economically practical solutions for what to do with associated gas at legacy sites. Assuming a global adoption of ZRF 2030 could be achieved. In that case, an operating environment would be created to enable the World Bank's GGFR to aid governments in developing regulatory frameworks, capability and capacity, and to address flaring (GINT4). However, according to another interviewee:

"This approach needs clarification of what to do with retrospective situations of which there are 16,000 flare sites globally" (GINT2).

The initiatives have the necessary knowledge and market power to secure commitments from their members to build the ZRF principles into globally accepted standards; potentially starting with better knowledge management. However, they need to pick up the pace. Despite a lack of political authority, the initiatives could create and deploy normative standards and rules if reasonably paired with their market and knowledge resources without ascribing to a complete regulatory regime. Such a deployment of norms may then better influence behaviours in what to do with associated gas. I assume that the global organisations supporting the climate initiatives have the needed knowledge and marketability to secure commitments from their members to create and implement the norms.

6.2.6   Policy solution #6: Better use of climate risk to collaborate and increase flare-out projects

This policy solution targets a lack of market instruments and horizon collaboration. It could also lead to an increased number of flare-out implementation projects. According to an interviewee, the initiatives working with country partners need thousands of projects to tackle flaring at over 16,000 global sites (GINT2). The creation of ZRF 2030 was due to over 70 organisations and initiatives commitment to end flaring by 2030 (GINT2). As shown in an earlier section, the World Bank has an estimated cost of over $100 billion for such an endeavour, which requires two approaches.

First, new and scalable business models are needed. GGFR needs to follow through in places like Nigeria, where there is the willingness to change by financing projects with simplistic and realistic solutions. A new business model that outsources flare reduction, which delivers simplistic and realistic but scalable solutions and seed financing (GINT2), may be needed. Notably, Nigeria has adopted the outsourcing model, and Oman is working with F2V on a similar model.

Second, global associated gas flare governance initiatives need better use of the current enhanced awareness of climate change risk. Climate-related risks on oil and gas companies are becoming a reality on the balance sheets of oil companies. According to one interviewee, financial services companies with over $48 trillion assets would only now lend to oil and gas companies if specific climate risk is mitigated (GINT2). Furthermore, there is increasing recognition of an existential climate-related risk crystallising to lead to changes in strategic directions of the oil and gas companies to mitigate the risk (GINT1).

Perhaps what is happening with divestments from fossil fuels is an opportunity to influence the oil companies to take more concrete actions. For example, Norway is looking to divest from its fossil fuel business with Equinor, formally Statoil[1]. Shell is diversifying into electricity generation and distribution in the UK through the acquisition of First Utility Energy[2]. However, these divestments are long-tailed events and changes could be achieved in the meantime. For example, gas and oil companies could be influenced to reconfigure their balance sheets better to recognise gas flare reduction activities as climate risk.

Assuming oil and gas companies are rational economic entities, they would not typically flare if there were economically practical options. A workable solution could start with understanding the commercial barriers and reduce these, which I supply for the Nigerian level solutions.

---

[1] Adam Vaughan, "Norway to sell off fossil fuel stocks worth more than $8 billion," *New Scientist*, 12 June 2019, https://www.newscientist.com/article/2206472-norway-to-sell-off-fossil-fuel-stocks-worth-more-than-8-billion/#.

[2] "Shell completes acquisition of First Utility" Shell – media release 28 February 2018, https://www.shell.co.uk/media/2018-media-releases/shell-completes-acquisition-of-first-utility.html.

6.2.7 Policy solution #7: Constant monitoring and evaluation of progress against goals

This policy solution targets duplication of activities, a lack of knowledge management and progress. Whether the preceding solutions are adopted or not, there could be constant evaluation of global associated gas flare governance initiatives against their goals annually. According to an interviewee:

"Each initiative should be evaluated against its complete goals. The initiatives could be progressively monitored against benchmarks of collaboration, sharing knowledge and progress against goals" (GINT6).

For example, the GGFR and the GMI need to measure their progress against their goals. Another interviewee agreed that the measurement could be at a specified frequency (GINT5). According to another interviewee, there are valid criticisms of these initiatives out there (GINT2).

According to a different interviewee, "GGFR and GMI have around for more than 15 years. However, there are no concrete results from these initiatives" (GINT7).

What is also needed is designing and implementing a consistent monitoring and evaluation process for global associated gas flare governance initiatives. In any case, the initiatives need to address a lack of concrete results. However, they also need to be held accountable (GINT6). Also, GGFR and ZRF 2030 could use the convening authority of the World Bank and knowledge of the deployment of development finance to do more in this space (GINT3).

6.3 Policy solutions for the barriers and origins at the Nigerian level

Research objective seven: to devise solutions to the manifested barriers and origins for the systematised (b) Nigerian associated gas flare governance: Table 6-2 captures seven devised policy solutions to tackle the manifested barriers and root origins at the Nigerian level. Like the global level, there are solutions with multiple applicability. Each policy solution targets at least two manifested barriers, and #5 seems to be the most applicable. As with the global level, a practical application of the policy solutions could address root origin #6 as I embedded systems thinking in each of them.

However, there were no clear policy solutions for barriers #2, #4, #7 and #8. These are persistent and require gas-specific legislation to be resolved. In addition, the manifested barriers #2 and #7 have no

clear, practical solutions. As such, I only supply further insights. Furthermore, the manifested barrier # 8 only has one practical solution: holding DPR to a greater level of accountability. DPR is now implementing the associated gas flare commercialisation programme. Therefore, its supervising Ministry (MPR) should hold them to account, rather than the current direct reporting line to the President.

A summary of the view of four interviewees' insights outlined below captures the interconnected solutions:

"A connected approach does two things. First, it leads to a better governance process. Second, it shows Nigeria has taken a bold step in commercialising its associated gas" (NGN1 and NGN16-18).

Another interviewee summarised the problems and solutions as follows:

"We could do better in climate financing if DPR and DCC work together. However, it is unclear what is an associated gas flare project and when it is a climate change qualifiable project. Moreover, DCC's request for support does not extensively cover how we can secure climate finance" (NGN11).

For solution #5 "gas-specific legislation is needed", I supply a case for understanding and more of a reality than a solution, as the process of enacting primary legislation is complicated. In other cases, I sequence the solutions to enable parts to be implemented, if appropriate to the context. Furthermore, climate financing and fossil fuels are a matter of negotiations as part of COP26 and ongoing debates. I present the policy solutions and their applicability in what follows.

Table 6-2 Policy solutions for the Nigerian level

Policy solutions by interviewees	Targeted manifested barriers and rankings									
	3rd	4th	2nd	6th	5th	5th	1st	5th	5th	5th
	#1 Dysfunctional incentivisation and unclear identity for gas	#2 Mismatched political/investment cycles	#3 Lack of or inaccurate data and fragmented MRV	#4 Lack of climate mitigation financing	#5 High counterparty risk and lack of infrastructure investment	#6 Lack of commercial frameworks and sanctity of guarantees	#7 Lack of enabling legislation	#8 Breakdown in governance process	#9 Lack of regulatory clarity and cross cutting coordination	#10 lack of capability and uncoordinated international support
#1 Advocacy, better incentivisation, legislation & access to gas-for-cooking1(*NGN1, NGN3-6, NGN10, NGN12-13, NGN16-18 & NGN19*)	█				█					
#2 DPR relying on NOSDRA data and collaborating with DCC to develop MRV (*NGN1, NGN2, NGN8, & NGN10*)			█						█	█
#3 A multi-pronged approach to tackle high-counterparty risk and lack of infrastructure (*NGN1, NGN2, NGN3-6, NGN8 & NGN10*)					█	█				
#4 Improving the commercial frameworks and programmatic approach to gas commercialisation (*NGN3-6, NGN7, NGN8, NGN10, NGN11 and NGN19*)						█			█	
#5 Gas-specific legislation is critically needed (*NGN1, NGN7, NGN8, NGN10*)	█				█	█	█		█	
#6 Enhance regulatory clarity through National Strategic Implementation Group (*NGN1, NGN2, NGN3-6, NGN7, NGN8NGN10, NGN11*)									█	█
#7 Attract and empower competent staff and increase international actors' collaboration (NGN1, NGN2, NGN3-6)									█	█
█ The solution targets the highlighted and cross-referenced barrier										

Source: Author

Note: *Solution #1 starts to tackle origin#4, and #6 by enabling a system thinking and solution #2, #3, #4, #6 and #7 also starts to tackle origin #6 (lack of systems thinking).*

6.3.1 Policy solution #1 Advocacy, better incentivisation, legislation and access to gas-for-cooking

This policy solution consists of three parts (**Figure 6-1**). It tackles dysfunctional incentivisation and lack of associated gas identity. It is also potentially applicable to high counterparty risk and lack of infrastructure. The solution could start addressing subsidies and non-viable downstream electricity market, and lack of systems thinking. Nigeria's associated gas flare governance goals are heavily linked but positioned to make it a regional climate leader through better advocacy by international partners in the build-up to COP26 (NGN3-6). However, the current international support offered to the DCC (as captured in **Table 4-14)** could be strengthened in critical areas to better advocate for this solution (NGN10).

For example, the international partners could use existing capability support for policy themes. The support could also be extended to cover power-to-industry and power-to-housing and advocacy for removing subsidies (NGN12-13). According to two interviewees, Nigeria could enhance its associated gas commercialisation through cross-cutting coordination (NGN12-13). Indeed, with a growing population and increasing energy demand, associated gas could have a multiplier effect across crucial areas of the existing support such as agriculture, power-for-industry and power-housing. However, international partners need to improve their advocacy and coordination of their own financial and technical assistance, to help Nigeria achieve these objectives.

Nigeria needs a more balanced regional and industry incentivisation scheme, reverting to those in the 2007 gas master plan that were more transparent (NGN10). However, according to an interviewee, a lack of specific legislation is one reason why associated gas lacks a commercial identity (NGN1). Neighbouring countries such as Ghana took only two years to create their PIB, while investors have been clamouring for one in Nigeria for decades. Without a PIB and the investor protection it offers, the high uncertainty means investors are less attracted to infrastructure investment. This lack of legislation is a problem especially given the low and ever-diminishing fossil-fuel financing (NGN10).

The Nigerian Bulk Electricity Trading Company (**NBET**), as a gas aggregator, is a bottleneck for associated gas commercialisation in the gas-to-power sector (NGN2). Therefore, Nigeria could focus on gas-to-cooking, which has low counterparty risk and needs lower infrastructure investment

(NGN19). Close to 150 million Nigerians lack access to clean cooking facilities, where containerised solutions could work. Three interviewees supported a containerised approach for access to gas-for-cooking, suggesting a community-centred approach as a means of testing and improving the commercial frameworks (NGN16-18).

Suppose the international and Nigerian partners work through this solution collaboratively. In that case, it also starts to address origin #6, a lack of systems thinking to help Nigeria better connect the dots. However, the solution would be ineffective without legislation because investors may need their rights enshrined in primary law to invest in Nigeria's gas infrastructure.

Advocacy for evidence based incentivisation		But also starts to tackle origin #4 (subsidies and non-viable downstream market) and #6 (lack of systems thinking)
+ Nigeria's opportunity to be a climate leader among the African Climate Action Negotiation Group + Nigeria's commercial integrity and independence + Decrease levels of abstraction + Fix disconnects in messaging and narrative + Refocus the problem *Tackles barrier #1 lack of commercial and climate identity for gas*		
Gas-specific legislation	**Increased gas-for-cooking**	
+ Pass the PIB: Stronger, gas-specific legislation gives gas its identity + Ghana's experience shows it can be done + Investors want gas-specific legislation to protect their rights *Tackles barrier #1 lack of gas identity, but barrier #7 needs to be first tackled.*	+ Less complexities with lower infrastructure investment required + Great consumption potential – potential for community-based approach and 178m Nigerians need clean cooking facilities + Lower counterparty risk – as no government as a counterparty in supply chain *Tackles barrier #1 identity for gas but potentially, #5 and #6*	

Figure 6-1 Policy solution #1 advocacy, evidence, legislation, and increased gas-for-cooking

Source: Author

6.3.2   Policy solution #2 DPR relying on NOSDRA data and collaborating with DCC to develop MRV

This solution tackles a lack of inaccurate data and fragmented MRV, a lack of regulatory clarity and cross-cutting coordination, a lack of capability and uncoordinated support, and a lack of systems thinking. For example, the DPR could use NOSDRA data to monitor, report and verify flare-out commitments (NGN1 and NGN19). According to another group of interviewees:

"DPR must publish annual reports about its compliance and holding oil companies to account for the flare out programme. The current self-reporting by oil companies leads to allegations of discrepancies between the data sent to DPR and independent gas-flare-out trackers. There have been claims of lost revenue to the tune of $400 - $500m, and this does not bode well for Nigeria and its intention to generate investment in infrastructure" (GINT1, GINT2, GINT3-6 and GINT10).

NEITI, which the Nigerian President sponsors, could use their transparency mandate to strengthen this inter-government agency relationship. Indeed, NEITI has a role to play, extending its mandate to cover flaring and accuracy of flare data and penalty in addition to revenue from oil. FOSTER, a UK FCDO-sponsored transparency and capacity building initiative, supports the Lower House of the National Assembly Gas Flare Committee investigating these issues. Furthermore, Nigeria needs to hold the oil companies accountable to the standards of their home countries as their home countries have allowed for stricter penalties and enforcement of fines (NGN10).

It also does not make sense that both DPR (an agency of the Ministry of Petroleum) and DCC (an agency of the Ministry of Environment) independently develop separate MRVs. From the interviews conducted in September 2020, it seems DPR's MRV development was still in a design phase, and DCC is still seeking international financing for its MRV (NGN9 and NGN12-13). Therefore, it makes sense for both MRV development to be combined to save money and allow compatibility of systems and sharing data in the future. In addition, this approach shows cross-cutting coordination. It encourages systems thinking (NGN12-13), which is a root origin to barriers for better use of gas and securing climate actions in Nigeria. This solution does not require primary legislation as implementation could be at the department level with ministerial interventions.

DPR acknowledges the above challenges and the need to deepen their climate change mitigation competencies as this unattributed view of DPR interviewees (collated) shows:

"We appreciate all the aspiration that has taken much relevance globally around climate change. However, our competency needs to be deepened quickly to the point where it allows us to start churning out regulatory governing instruments to begin to help the industry" (interviewee's *reference withheld* to retain anonymity).

6.3.3 Policy solution #3 A multi- approach to tackle counterparty risk and lack of infrastructure

This solution tackles high counterparty risk, a lack of infrastructure investment, a lack of commercial frameworks and sanctity of guarantees, and a lack of systems thinking. Notably, despite being complex, this solution does not require primary legislation as a starting point. The solution also requires using a system thinking approach to connect the dots. In addition, there is a need for assurances for the high counterparty risk. This assurance needs to factor in the standoff with oil companies (Error! Reference source not found.) and a presidential intervention to enhance DPR's review of the industry code of conduct.

Oil companies could invest in pipe associated gas to aggregators like NBET to avoid losing their licence. However, they would need stronger assurances on dealing with the high counterparty risk. According to an interviewee:

"Should the Nigerian government fail to resolve high counterparty risk, the oil companies could counter the threat to revoke their licences by capping the oil wells" (NGN1).

Consider the following example supplied by another interviewee:

"Company A secures a licence from DPR, secured access to associated gas, invest billions in infrastructure, pipes the associated gas through NBET to a GENCO, which sells to a DISCO. If they do not get paid when due, they could go bankrupt. Suppose another commercial entity (Company B) wants to venture into the same business. In that case, it is likely to learn lessons from Company A's experience and avoid such an investment" (NGN2).

DPR is considering the high counterparty risk in its review of the gas sector code of conduct. However, the challenge is with the bulk aggregator (NBET) and the electricity generation and distribution companies (GENCOs and DISCOs). Besides, there is a constraint on DPR's actions, as the problem rests with federal and state-owned agencies outside their control (NGN8). Perhaps an intervention at the presidential level is needed, given the criticality of the problem. Stimulating gas-to-cooking demand (policy solution #1) could reduce barrier #5. However, the gas-to-power demand still needs to be fulfilled, requiring tackling the high government as counterparty risk.

While it could be profitable for oil companies to commercialise, the flare associated gas by generating electricity, they are unlikely to do so (NGN3-6) due to ageing infrastructures. Solving the high government counterparty risk and insolvency problem of the electricity sector should be a priority. It could be a priority because investors are unlikely to build infrastructures to supply gas to high-risk counterparties (NGN2). Nigeria needs to find and implement a balanced approach between penalties, regulation and building infrastructures. According to a group of interviewees, "it is still cheaper to flare and pay the penalty than invest in infrastructures" (NGN3-6).

The current regulatory focus on pricing needs to shift to the transparency of government processes and policies, where agencies like NEITI have a crucial role in their transparency mandate. According to an interviewee:

"Instead of dictating prices to investors on the assumption that there are willing and able buyers, Nigeria could instead focus on building more pipelines. Nigeria could also focus on enhancing the transparency of its actions and policies to attract investors" (NGN2).

Connecting the dots on the insights above points to the need for strategic government interventions. Such interventions could include creating an enabling infrastructure investment environment through legislation, evidence-based incentivisation and kickstarting a connected change programme. One interviewee captured this view best by saying:

"To bring investors into gas infrastructure, Nigeria needs to offer the right investment returns, which captures the current context and state of the sector which is highly unattractive" (NGN10).

Indeed, Nigeria needs to prioritise infrastructure development, summed up by another interviewee who said:

"We (Nigeria) have plenty of associated gas but not enough infrastructures. Suppose I manage one of the oil companies. In that case, flaring is an embarrassment for me, but what can I do without the required infrastructure? I cannot ask my company to subsidise Nigeria's infrastructure investment needs with our investors' capital" (NGN2).

6.3.4 Policy solution #4 Improving the commercial frameworks and programmatic approach

This solution has two parts: tackling a lack of commercial frameworks and sanctity of guarantees and addressing the lack of regulatory clarity and cross-cutting coordination. In addition, the solution starts to address a lack of systems thinking.

Nigeria could develop better commercial frameworks aspect of the solution through an ongoing DPR review which also supplies an opportunity for cross-cutting coordination. According to an interviewee, the DPR review is targeted at better incentivising the sector. It focuses on the upstream and downstream gas sectors (NGN8). However, another group of interviewees suggested that DPR's review could include the downstream and consider how to better reward investors for the lack of ease of doing business in Nigeria (NGN3-6). Indeed, for Nigeria to scale up from the three active large-scale associated gas processing sites, the commercial frameworks and ease of doing business need to improve.

My interviewees supplied examples of the lack of sanctity of agreements. The examples included an arbitrary change of contracts due to dysfunctional incentivisation and unkept promises. According to a group of interviewees, the oil companies were awarded ministerial exemptions for their sites because they had started flare-out projects and were keeping to contractual agreements (NGN7, NGN8 and NGN11). The above counterclaim could not be verified. However, another group of interviewees suggested that these exemptions could lead to an unintended solution. On the other hand, successful commercialisation could be a positive market signal (NGN3-6).

There is also a need to adopt a disciplined, programmatic approach to the associated gas flare commercialisation programme and tackle concerns of lack of sanctity. Such an approach could also address the lack of data and enables transparently executing the programme. For example, two interviewees suggested that a detailed analysis and pre-programme exploration would have led to a better quality of flare gas data. Tackling this problem could have reduced the number of start-stop-start occurrences and clarified any encumbrances on the flare sites to aid better investor communications (NGN10 and NGN19).

Whatever the case, even though the oil companies had been flaring on these sites for decades, flares were ongoing as of granting the exemptions to exclude these flare sites. A disciplined programmatic approach could have reduced delays; instead, the programme drags on; five years after

commencement with increased uncertainty of successful completion (NGN10). Notably, implementing this solution could also be without primary legislation. However, NEITI and similar initiatives need to enhance transparency on critical programmes like gas flare commercialisation.

6.3.5   Policy solution #5 Gas-specific legislation is critically needed

This insight is more of a case for posterity than a solution. Supplying gas-specific legislation in addition to tackling manifested barrier #7 could address other barriers. However, the two-decade-old problem makes it a persistently chronic barrier. The policy solution echoes that of NEITI as to why Nigeria urgently needs gas-specific legislation and supplies new insights. Without legislation, critical solutions remain unimplementable, and associated gas identity remains blurred with that of oil.

For example, until the Flared Gas Regulation of 2018, Nigeria and the oil and gas companies relied on the 1969 Petroleum Act to decide what to do with gas. Moreover, the 2018 Flared Gas Regulation is only another incremental advancement. It does not address the challenge of a lack of gas-specific legislation. Echoing the above view, two interviewees wondered why the Nigerian President chose to veto the proposed Petroleum Industry Governance Bill, which could have supplied clarity in governance. Instead, the President chose to reintroduce the PIB without addressing the unresolved differences between the Executive and Legislatures (NGN1 and NGN10).

The PIB is critical to enable better policymaking and regulation. Nigeria's lack of legislation introduces a lack of regulatory clarity and other critical barriers. For example, although Nigeria's gas governance goals are laudable, they are not anchored in primary legislation, making them unsustainable. Instead, the goals are linked to the 2017 gas policy and the 2018 flared gas regulation and Executive Orders (NGN1). Furthermore, while the 60-year institution of gas governance evolution may have yielded progress, gas-specific legislation is needed to solidify the progress (NGN10).

Nigeria may have unintentionally applied an incremental and gradualist approach to building its institutions of gas governance. However, the investor community may be already tired of waiting for the government to protect their rights in legislation; and this is a critical barrier. Gas-specific legislation gives a stamp of endorsement to the financial models of investors, greater certainty in the investment decision, and investors may be tired of waiting for it (NGN7 and NGN8).

Without this legislation, it is doubtful that Nigeria can tackle its lack of gas harvesting infrastructures. Investors may continue to divert from Nigeria, given the other barriers and how the lack of legislation

increases them (NGN8 and NGN10). Multiple barriers, including lack of clear identity for gas (#1) to lack of clarity in regulation (#9), are connected to lack of enabling legislation and the reliance on the outdated, over 60-year-old Petroleum Act of 1969. The gas-specific legislation would enable implementing the single proposed regulator system, bringing clarity of roles and a sound regulatory framework.

6.3.6   Policy solution #6 Enhance regulatory clarity through National Strategic Implementation Group

As presented in **Figure 6-2**, this solution comprises four parts. First, it tackles a lack of regulatory clarity and cross-cutting coordination, lack of capability, and uncoordinated support. Second, it starts to address a lack of systems thinking, but gas-specific legislation is needed. Notably, this solution has multiple moving parts. However, the parts could be brought together under strategic and operational working groups. These groups could comprise staff from the relevant supervisory ministries with active roles played by NEITI and international NGOs to enhance accountability and transparency.

According to an interviewee, the National Economic Council is already considering creating holistic plans. Such plans are meant to be cross-cutting approaches to deliver Nigeria's gas governance goals (NGN10). For example, the UK is one of the international donors supplying capability building support for the DCC through a secondment of a specialist from the Department for Business, Energy, and Industrial Strategy (BEIS). Perhaps this offer of support could be extended to include advising Nigeria on how BEIS corralled other supervisory departments to design the UK's Net Zero Plans. The UK adopted an NSIG (National Strategic Implementation Group) approach. The approach seems to be working towards delivering net zero, at least from a design perspective.

Nigeria needs gas-specific legislation to implement the proposed delineated (2017 gas policy) policy, regulatory and commercial functions. According to at least nine interviewees, Nigeria could achieve clarity in the regulatory framework and cross-cutting coordination by implementing the proposed delineated functions (NGN1, NGN2, NGN3-6, NGN7, NGN8 and NGN11).

Another suggested way forward was to create the 2017 policy-proposed Department for Gas (NGN10). Another interviewee echoed this suggestion, stating that regulatory clarity starts with realigning DPR's purpose and finalising the split between Nigeria's petroleum and gas governance (NGN2). Interestingly, my research also showed DPR's emerging awareness of the need to collaborate better with DCC on climate action. However, I could not confirm the same sense of purpose from DCC. For

example, two DPR interviewees suggested better collaboration and working with DCC. DCC-led advocacy and awareness campaigns could help in enhancing DPR's climate action knowledge and access to finance for the commercialisation projects.

Gas-specific legislation		
+ Create a National Strategic Implementation Group: National Economic Council, Ministry of Petroleum, Ministry of Environment and Ministry of Budget and Finance as supervisory Ministries, but bring in NEITI and INGOs for increased transparency and capabilities. + Create Operational Implementation Group: Permanent Secretaries of the Supervisory Ministries, Director Generals, Directors and Senior Managers but bring in NEITI and INGOs for increased transparency and capabilities.		
+Implement the delineated policy, regulatory and commercial functions as in the 2017 gas policy (NGN1, NGN2, NGN3-6, NGN7, NGN8 and NGN11)	+Start with DPR and realistically separate functions but also separate the governance of petroleum and gas + Create the Department for Gas as proposed in the 2017 policy as the single independent regulator (one regulator equals single point of focus and clarity) (NGN2, NGN7 and NGN10)	+ DPR are aware of the need to collaborate better with DCC but climate action awareness is nascent (NGN8 and NGN11) + Increased awareness could start with exchange of gas and climate action specialist or creation of corresponding desk between DPR and DCC (NGN10 and NGN11) + The gas governance model proposed in the 2017 gas policy could be expanded to better include climate change and design the interface between both gas and climate action tackling the current fragmented approach (NGN3-6 and NGN11)

Figure 6-2 Policy solution for better regulatory clarity and coordination

Source: Author

6.3.7   Policy solution #7 Attract and empower competent staff and increase collaboration

This policy solution is in two parts and is targeted at a lack of regulatory clarity and cross-cutting coordination and lack of capability and uncoordinated support. It starts to address the lack of systems thinking in two ways. First, Nigeria needs to find a way to attract and keep qualified policy staff who are as competent as their counterparts in the regulatory and commercial functions. Second, the Nigerian Civil Servants capabilities could match the private sector's (NGN1). Notably, Nigerian Civil Servants tend to be in the "job for life" and could be highly capable if empowered to do their jobs (NGN3-6).

Another group of interviewees agreed that a lack of enabling environment often arises due to contradictory directives from new Ministers, which leads to a lack of continuity in policies (NGN3-6). However, with enhanced capability development programmes and strengthening the system, Nigerian civil servants could improve gas governance (NGN1). Another interviewee suggested that Nigeria cannot attract private sector infrastructure finance unless it can show a high level of capability. Therefore, the problem links to a lack of delineated functions (NGN2).

Staffing decisions for technical staff may need to be competency-based. However, ministerial while supervision is needed (see the breakdown in governance), the reality is that staffing decisions for higher office may reflect a balance of politics. It is easy to criticise developing countries like Nigeria. Still, the reality is that in developed countries like the UK, ministerial appointments are political, and Ministers do not have to be technical experts but political juggernauts.

A way forward is that international and Nigerian partners need to continue to focus efforts on capability building. However, this focus needs to also be on a system strengthening perspective, empowering civil servants to collaborate and partner more transparently. NEITI could play a role in this. In addition, the global actors seeking to help DCC build its capabilities could collaborate better at a horizontal and Nigerian level.

While the efforts to build capabilities are commendable, they could be strengthened to enhance collaboration by the global actors. For example, DCC seemed uninterested in the commercialisation programme (NGN1). The enhancement of Nigeria's NDC could be an opportunity for donors to insist on better coordination of their support. In developing DCC's capabilities, the donors could insist on cross-cutting coordination. They could advocate combining the two MRVs in development and creating an enabling environment for collaboration, which is a cornerstone of an efficient process.

6.4   Prioritisation of targeted policy solutions for the global and Nigerian level

My thesis is structured around a simple conceptual framework: an associated global and Nigerian gas flare governance system is viable if it has coherent goals, effective instruments and efficient processes. Therefore, in what follows, I sequence and prioritise the global and Nigerian policy solutions in three groups. First, are the solutions which are not dependent on either sponsors' politics (global level) or a gas-specific legislation (Nigerian level). The second group are policy solutions which are partially dependent on sponsors' politics and a gas specific legislation. The third group are policy solutions that are wholly dependent on sponsors' politics and a gas-specific legislation.

6.4.1   Prioritisation of targeted policy solutions for the global level

Research objective 8: to determine the sequencing and prioritisation of the policy solutions for the systematised (a) global associated gas flare governance: I found seven solutions to tackle the significant barriers and root origins for the global level. The initiatives could implement three of the solution without the need to gain permission from the sponsors. A sequencing and prioritisation and of the solutions could help tackle multiple barriers and the lack of systems thinking which is a root origin. For example, meeting regularly to create a joint programme of activities (#3) seems to be the most applicable policy solution for the global level. By working together, the global initiative actors could also start creating norms that could become standards over time, therefore tackling a sense of propriety and a lack of political authority and legitimacy.

6.4.1.1   Policy solutions which are not dependent on sponsors' politics

Two policy solutions with applicability for effective global associated gas flare governance processes and instruments are not dependent on sponsors' politics and prioritised for implementation. Better use of climate risk and collaboratively advocate for increasing the number of flare-out projects (#6) and constant monitoring and evaluation of activities and progress against goals (#7) are within the mandates of the initiatives.

While better use of climate risk (policy solution #6) tackles only market instruments, it tackles two barriers in the processes category. First, it could be implemented without changing the existing mandate of the initiatives. Second, as highlighted in **section 6.2.6**, this policy solution requires better effort by the initiatives to coordinate with each other and crystalise the impact for oil and gas companies responsible for flaring. Recent events such as donors divesting from fossil fuel and financial services firms "greening" their investments could help strengthen such advocacies.

Constant monitoring and evaluation with transparent reporting are needed to support the integrity of the UN process that led to the creation of the initiatives (section **6.2.7**). In addition, monitoring and evaluation is a principle of the UNFCCC process of non-state actors tackling climate change. These two solutions collectively contribute to increasing the viability of the global associated gas flare governance system by making their instruments and processes more effective.

6.4.1.2   Policy solutions which are partially dependent on sponsors' politics

Four policy solutions apply to goal incoherence, ineffective instruments and processes and partially depend on sponsors' politics. However, the solutions could be sequenced, starting with the parts that do not require a change in the initiatives' mandates.

The initiatives do not need to deal with the politics of sponsors for better horizon scanning, increasing their awareness of other initiatives and engagement (which was low). This solution could be prioritised at a minimum because it supplies insights for other solutions highlighted above and below. However, when it comes to orchestrated leadership, this might require dealing with the politics of sponsors.

It could be within the existing mandates of the global initiatives to meet more often. The initiatives could meet more often through virtual meetings as influenced by COVID-19 restrictions. These meetings could improve cases for creating a joint programme of activities, partially implementing policy solution #3.

As has been highlighted, this approach of a regular meeting could tackle at least five barriers. A lack of horizon scanning, and a weak knowledge management process is a first ranked significant barrier, and duplication of activities is a second-ranked barrier. This approach could also start to address a lack of systems thinking, which is an origin.

Better knowledge management targets four significant barriers and three root origins, making it one of the most effective solutions. However, it requires dealing with the politics of sponsors to be effectively implemented. This aspect of sharing their knowledge is critical to creating effective knowledge, market and normative instruments. It does not require changing the mandates of the initiatives or dealing with the politics of sponsors.

Furthermore, the solution could be supported by the coordinated development of communities of practice where knowledge is shared to create effective instruments. While this solution may sound simplistic and challenging to implement, its implementation already has elements in place. For example, standards are precursors to compliance-based systems but require practical knowledge and market instruments as enablers. Notable, the solution would require better messaging and managing.

Better knowledge management could also start with the ZRF principles of real options to encourage oil companies to treat associated gas as a contingent asset. Such an approach could work in countries

such as Nigeria with high gas-to-oil ratios. However, the aspect of global adoption of the ZRF principles itself may take decades.

6.4.1.3   Policy solutions that are dependent on the politics of sponsors

The policy solution of applying a broad-church approach allows for deliberate broad goals and specialisation. It would require sponsors approval. However, it is a solution that could happen over time if the initiatives start implementing the first and second prioritised targeted policy solutions.

6.4.2   Prioritisation of targeted policy solutions for the Nigerian level

Research objective 8: to determine the sequencing and prioritisation of the policy solutions for the systematised (b) Nigerian associated gas flare governance: While a lack of gas-specific legislation and the politics of hydrocarbon seem to be root origins, there are practical solutions Nigeria could implement without dealing with these two long-term challenges. Simple solutions could include using Ministerial mandates and advocacy to improve inter-ministerial collaboration which tackle a lack of systems thinking which is a root origin. Besides, getting the global donors to engage in better horizon scanning and encouraging collaboration at the Nigerian level increases systems thinking but reduces the negative impact of the "nature of donor funding" which is shifting away from fossil fuel interventions.

6.4.2.1   Policy solutions that are not dependent on gas-specific legislation

Four policy solutions with applicability to effective instruments and efficient processes at the Nigerian level of associated gas flare governance could be prioritised for implementation. A significant barrier was a lack of data and the fragmented development of MRV by the DPR and the DCC. The specific solution is for DPR to rely on NOSDRA (an agency of the MoE) data and collaborate with DCC to build an integrated MRV (#2).

Notably, one of the insights was the Minister of Environment's complaint that MOE/DCC are left out of crucial discussions. For example, DCC has little to no activity on flaring (interviewee code withheld for anonymity). Perhaps, this position by a Minister and the preceding could be used to prioritise this solution.

As suggested in the solutions section, the international donors could help DCC collaborate better with DPR to build an integrated MRV. At worst, the requirements for the MRV could be better connected. This solution also tackles the lack of cross-cutting coordination and uncoordinated international support, making it a priority.

This solution is complex; however, a multi-pronged approach does not need gas-specific legislation for implementation. Instead, as highlighted in the solutions section, it could be a part of the ongoing DPR review of the gas sector code of conduct. Still, it would require presidential level intervention, given that the downstream consumers of gas-to-power are state and federal agencies outside DPR's control.

The suggestions of improving the commercial framework and programmatic approach to associated gas commercialisation do not require gas-specific legislation to be implemented and prioritised. For example, as part of the international support package, international actors could become actively involved in the power-housing and power-to-industry.

The global initiatives could also support a community-based approach to gas-to-power and gas-for-cooking, improving the commercial framework. In addition, DPR's gas sector industry review could consider and propose better risk-reward metrics to incentivise investors. Furthermore, a programmatic approach could allow Nigerian governmental actors to predict the length of time better. This approach will better inform investors and manage expectations, assuming data were available and inter-agency collaboration could be more effective.

Although it sounds simplistic and all-encompassing, the suggested solution of attracting and empowering competent staff and increasing global actors' collaboration is practical. As highlighted, Nigerian civil servants stay in the job for life. However, they are disempowered due to a lack of continuity of leadership and direction. However, the above also leads to a lack of trust in their capability by Ministers who bring in special teams, which also means the capabilities of civil servants are not developed. Moreover, when the Ministers leave office, they take their people with them, which leads to institutional memory loss.

A key enabler to this solution is the ongoing capability-building programme for DCC, supported by 12 international and local partners. However, this programme could be better coordinated, enhancing the gas governance capability of existing civil servants. Such as solution starts with better coordination of processes by the international actors and contributing to a lack of systems thinking.

6.4.2.2 Policy solutions that are partially dependent on gas-specific legislation

One policy solution which applies to coherent goals, effective instruments and efficient processes could be the second implementation priority.

First, advocacy for better evidence-based incentivisation and access to gas-for-cooking (community-based approach) does not require legislation. Deep-rooted issues led to failure to pass the Petroleum Industry Bill for two decades. This lack of gas-specific legislation could put off potential advocates. In this space, international actors supplying funds for enhancing Nigeria's NDC could advocate for legislation through FOSTER and NEITI and be more focused on Nigeria, making its incentivisation process more transparent. Second, the international actors who are already funding activities in Nigeria could reprogramme donor funds to increase access to gas-for-cooking. However, such reprogramming of donor funds is never straightforward in practice.

6.4.2.3 Policy solutions that are dependent on gas-specific legislation

A lack of gas-specific legislation blocks two policy solutions that apply to effective instruments and efficient processes for Nigeria's gas governance. This approach is without considering that the lack of legislation also partially blocks a key solution to goal coherence. First, I have supplied background information and made a case for posterity, supporting NEITI's position on why Nigeria urgently needed gas-specific legislation. Second, Nigeria needs to implement the proposal from the 2017 gas policy for a single independent regulator. However, this cannot happen without primary legislation.

6.5 Viability of the global and Nigerian associated gas flare governance system

Research objective nine: to assess the viability of the systematised (a) global and (b) Nigerian associated gas flare governance after application of policy solutions: The result of the analysis is that there is a potential for the policy solutions to shift the global and Nigerian associated gas flare governance system towards minimum viability. However, global and Nigerian level actions need to be connected using systems thinking in **Figure 6-3.** However, see **Figure 6-4** and **Figure 6-5** for the global and Nigerian level views of viability of the systems.

Chapter 4 showed that while the global and Nigerian associated gas flare governance system could be systematised, they are constrained by 11 emerging barriers. These emerging barriers manifested in varying forms (eight at the global level and 10 at the Nigerian level) but to the same or greater levels

in **Chapter 5**. **Chapter 6** showed that the devised solutions could target the significant manifested barriers at their root origins.

Overall, there may be a potential for a single connected system. However, these findings mean that we currently have a two-part unconnected system. Therefore, further work is needed to validate the findings. This further work would require carefully unpacking global and Nigerian level sequenced and prioritised solutions to test the implementation potential of the solutions.

The work would also test the impact of the solutions on the barriers and origins. The green-tagged solutions do not depend on sponsors' politics. As such, the initiatives and Nigerian actors could prioritise the green-tagged solutions for short-term implementation. The focus of the work would be on the amber tagged solution for medium-term implementation with a plan to address the red tagged ones for longer term implementation

Figure 6-3 The theoretical global and Nigerian associated gas flare governance–post solutions

Source: Author

Lack of goal coherence				Targeted policy solutions for goal coherence	
Origins	**Barriers**	**Influences**		#1: Better horizon scanning, increased awareness, and engagement and orchestration	
#1 Politics of sponsors	#1 Lack of horizon scanning, awareness and engagement	#1 Lack of intelligent coordination			
		#2 Lack of steady communication		#2 Applying broad church approach for deliberate specialisation and broad goals and specialisation	
	#2 Lack of specialisation and overlapping goals	#3 Lack of sense of mutual direction		3# Meeting more often and creating joint programme of activities	

Lack of effective instruments				Targeted policy solutions for effective instruments	
Origins	**Barriers**	**Influences**		3# Meeting more often and creating joint programme of activities	
#2 Sense of proprietary knowledge	#3 Weak knowledge management	#4 Lack of effective knowledge instruments		#4 Better application of KM to develop market instruments, complete and consistent norms and standards	
#3 Transition from Kyoto to Paris Agreement	#4 Lack of market instruments and financing	#5 Lack of effective market instruments		#5 Application of real-options to improve ZRF flare-out principles and its global adoption	
#4 Lack of political authority or legitimacy	#5 Incomplete and inconsistent norms and standards	#6 Lack of effective normative instruments		#6 Better use of climate risk to collaboratively advocate to increase flare-out projects	

Lack of effective processes				Targeted policy solutions for efficient processes	
Origins	**Barriers**	**Influences**		3# Meeting more often and creating joint programme of activities	
#5 Lack of systems thinking	#6 Lack of horizonal collaboration	#7 Not knowing who to collaborate with		#4 Better application of KM to develop market instruments, complete and consistent norms and standards	
	#7 Duplication of activities and its passive acceptance	#8 Lack of enabling environment to collaborate		#6 Better use of climate risk to collaboratively advocate to increase flare-out projects	
	#8 Few flare-out projects, lack of progress and degrees of frustration	#9 Capability to collaborate		#7 Constant monitoring and evaluation of activities and progress against goals	

Legend

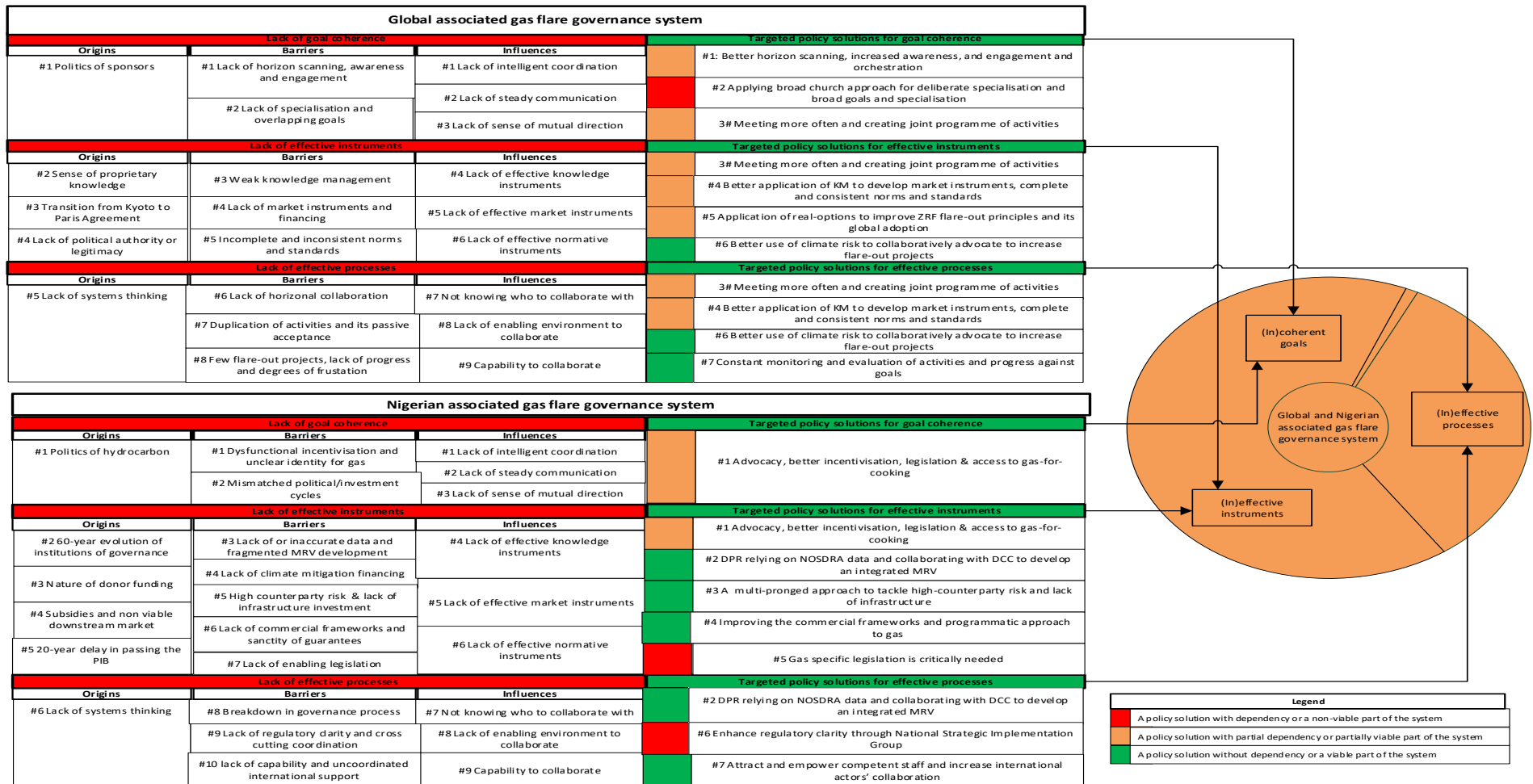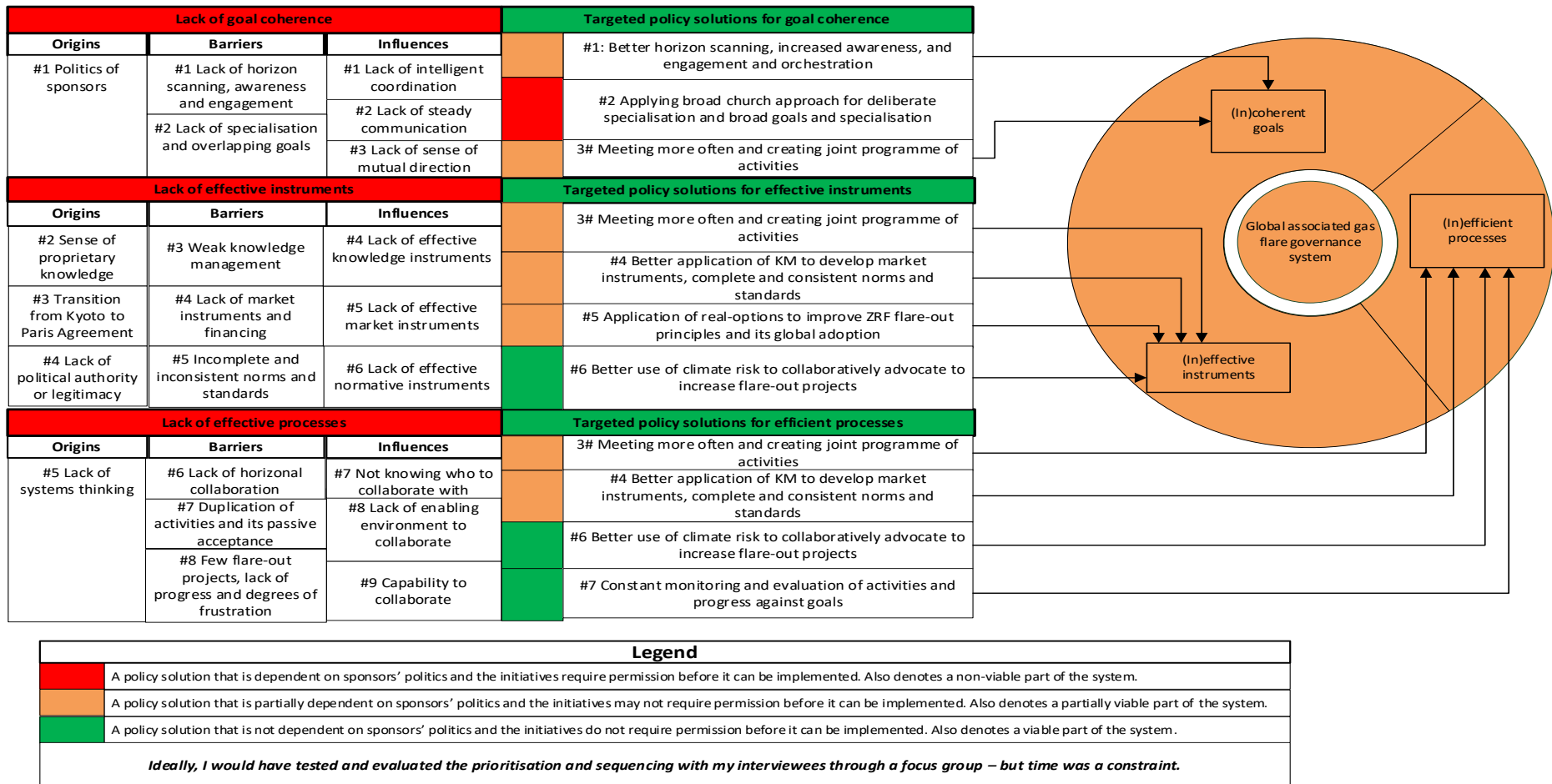|	
(red)	A policy solution that is dependent on sponsors' politics and the initiatives require permission before it can be implemented. Also denotes a non-viable part of the system.
(orange)	A policy solution that is partially dependent on sponsors' politics and the initiatives may not require permission before it can be implemented. Also denotes a partially viable part of the system.
(green)	A policy solution that is not dependent on sponsors' politics and the initiatives do not require permission before it can be implemented. Also denotes a viable part of the system.
	Ideally, I would have tested and evaluated the prioritisation and sequencing with my interviewees through a focus group – but time was a constraint.

Figure 6-4 The theoretical global associated gas flare governance–post solutions

Source: Author

Figure 6-5 The theoretical Nigerian associated gas flare governance–post solutions

Source: Author

6.6 Summary of chapter six

This chapter has added a policy solution lens to the critical analysis conducted in Error! Reference source not found.. The chapter suggested policy solutions to reduce the constraints on global and Nigerian gas governance systems. However, prioritising and applying the targeted policy solutions at both levels may only shift the system towards minimum viability.

The prioritisation of targeted policy solutions starts at the global level before progressing to the Nigerian level. At each abstraction level, I highlighted the root origins that need to be tackled to implement the policy solutions. I assume that my prioritisation and sequencing will be acceptable to the decision-makers, and I sequence the implementation of the solutions to show a future-state governance system.

For example, the initiatives need to manage sponsor politics at the global level to implement some solutions. However, they could implement some solutions without the need to navigate and reconcile the different needs of sponsors. A key barrier is a lack of primary legislation at the Nigerian level, which is a challenging, lengthy and complex process. In Nigeria, this has taken over two decades without gas-specific legislation. As with the global level, Nigerian actors could implement some solutions without enacting primary legislation.

While there are common potential linkages, I supply these in the discussion chapter, where I engage with the literature and contribute to the knowledge of gas governance. On reflection, it would have been ideal if I had tested and evaluated my solutions with my elite interviewees. This approach was my initial plan. However, the reality of conducting my fieldwork under COVID-19 restrictions applied. This reality meant I had to theorise in the absence of further intelligence on cost, timeframes and other insider insights on what is needed for the policy solutions to be implementable. While I have not considered some of the above aspects in my research, I am aware of their importance. Therefore, I make recommendations for further research on these areas – some of which I intend to conduct as a part of my post-doctoral research.

Chapter 7 Discussion of results and policy recommendations

7.1 Introduction to chapter seven

I aimed to systematise, the global and Nigerian abstraction levels associated gas flare governance. I framed my conceptual frameworks on goals, instruments and processes. This framing necessitates coming back more explicitly in this chapter (and the conclusion chapter) to draw out what the two levels of abstraction tell us about systematising associated gas flaring governance in an academic and practical sense. My policy recommendations could be a starting point, especially given the systemisation-barriers-solutions structure of my results Chapter **4**, **Chapter 5** and **Chapter 6**.

This chapter probably makes the most significant contribution to existing literature. To that end, I call out the key findings in **sections 7.2** for goals, **7.3** for instruments and **7.4** for processes. In each of these sections, I consider both sides of the debates for my findings and highlight where I have made new contributions to literature. **Section 7.5** brings together the debate in the context of the future of Nigeria's associated gas flare governance but draws insights from its national statement at COP26. Section **7.6** is a summary of the chapter.

7.2 (In)coherent goals of global and Nigerian associated gas flare governance

The study found that four significant barriers originate from the politics of sponsors and hydrocarbon and lead to incoherent associated gas flare governance goals (**Figure 7-1)**. While the barriers originate from politics, sponsors (for the global level) and hydrocarbon (for the Nigerian level), they have different contexts.
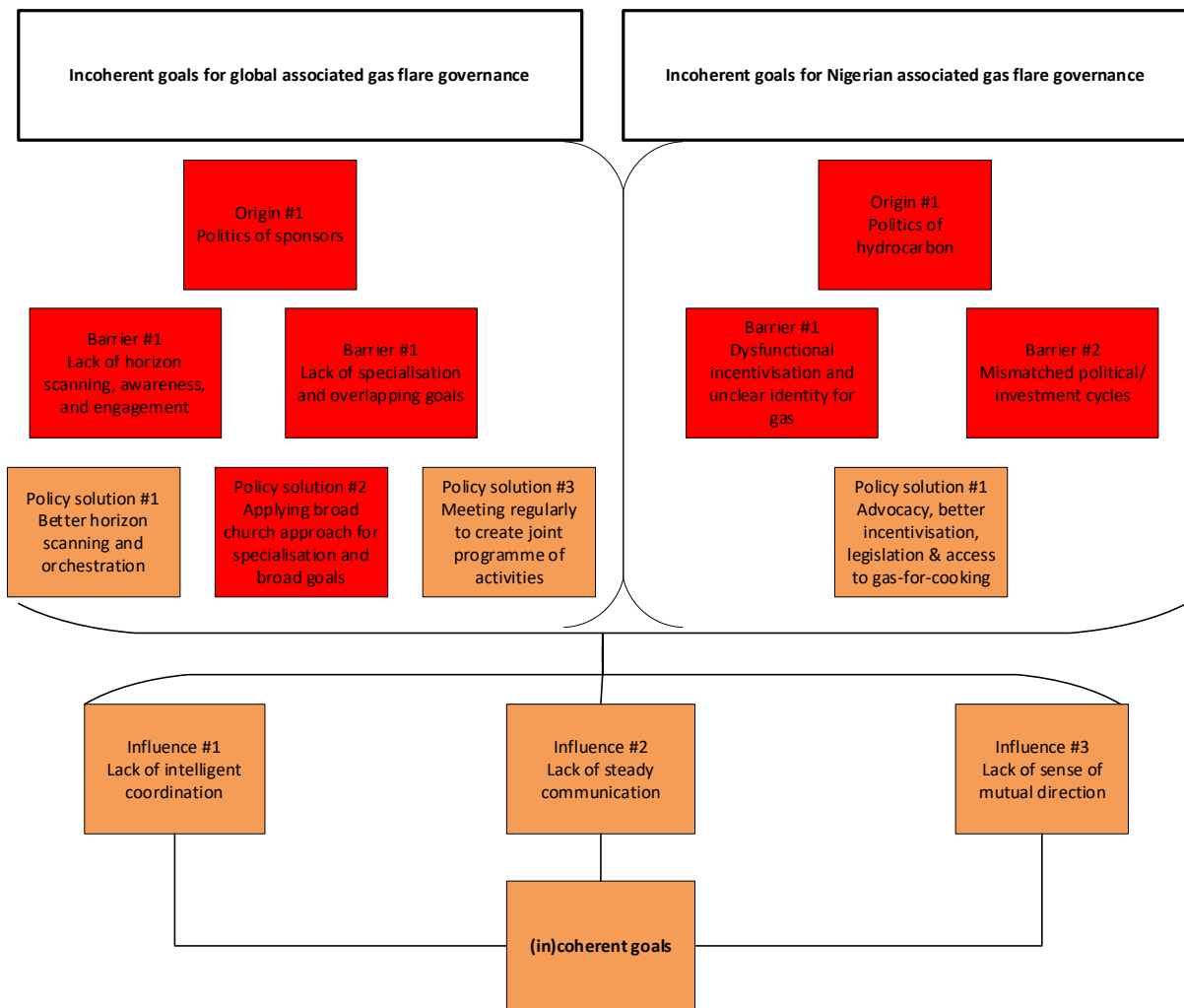
Figure 7-1 Origins and barriers to goal coherence and policy solutions

Note (applicable to figures 7-1; 7-2 and 7-3): Red – shows significant barriers, roots origins or solutions entirely blocked by a root origin. **Amber**- shows a solution partially blocked by a root origin. **Green** – shows a solution that is not blocked by a root origin.

Source: Author

Goal coherence starts with getting to know each other, intelligently coordinating, steadily communicating to ensure a sense of mutual direction (Najam et al., 2006). Besides, goal specificity could improve collaboration, outcomes, and impact of the work of the global initiatives (Biddle and Koontz, 2014). Moreover, coherent goals could be the steppingstone to the missing transparency and impact within the global climate initiatives circle (Fenhann et al., 2018).

In agreement with Morrison et al. (2019), one size does not fit all; the cost of exerting design, pragmatism, and framing power by the likes of OGCI can negatively affect outcomes. However, the

complex division of labour suggested by Dellmuth and Bloodgood (2019) seems to be missing in gas governance or further complicating its system. Indeed, the global initiatives owe it to the integrity of the UNFCCC process to achieve the targets they set themselves (Fenhann et al., 2018). Besides, in addition to sponsors' politics, attempts to avoid higher secretariat costs may steer the initiatives from deeper horizon scanning and better engagement for collaboration (Oberthür, 2009).

At the global level, the politics of sponsors wanting different things create strategic fields of associated gas flare governance goals (Fligstein and Mcadam, 2015). For example, GGFR and ZRF 2030 (World Bank initiatives) focus explicitly on ending flaring and increased gas use, while OGCI and GMI have a broader focus. Existing authors have explained limitations for specificity and how they lead to overlapping goals and lack of collaboration Biddle and Koontz, 2014; Rosenbloom, 2018; Morrison et al., 2019; Omri and Mabrouk, 2020). However, these situations also exist in environmental governance.

My systematisation of associated gas flare governance goals within a system gives context to these authors' insights. While the existing literature acknowledges the politics of sponsors as a root origin to environmental governance barriers, similar views may not exist for associated gas flare governance. Besides, the global initiatives seem to lack awareness of each other.

The resource curse is blamed for country-level (including Nigeria) hydrocarbon mismanagement (Thurber et al., 2011; Holden, 2013; Ramírez-Cendrero and Wirth, 2016; Akinola, 2017). While critiqued extensively (see John, 2011; Wengraf, 2017), my results show that the resource curse may still apply to Nigeria through hydrocarbon politics. (See dysfunctional incentivisation, unclear identity for gas and the politics of hydrocarbon as significant barriers and root origins for the Nigerian level analysis). Moreover, the political economy of hydrocarbon would be important to countries with abundant gas reserves.

The mismanagement of Nigeria's associated gas resource through flaring is where I link my study to the resource curse literature. When I talked about the politics of hydrocarbon, I talk about the primacy of oil revenue. We have this problem because the government wants to export more oil to earn rent money and this has always been the prime concern – supporting an exportable surplus of oil to earn revenue. This national stance has allowed international and domestic oil companies to get away with flaring because at the end of the day, the national actions to end flaring can be countered by responses that such actions might reduce the oil companies' ability to produce oil which the country does not want. See **Figure 5-12;** the Nigerian stand-off which shows Nigeria is hostage to its resource curse.

Notably, opportunities for coherence between Nigeria's associated gas flaring, NDC targets and SDGs have been highlighted in the literature (Antwi-Agyei et al., 2017; Elvidge et al., 2018). In agreement with Elvidge et al. (2018), my result shows that Nigeria seems to have a high proportion of its NDC linked to associated gas, which is expected of a gas-rich country that flares. However, my results challenge the authors' position that:

"Reduction of industrial flaring could meet about 4% of the unconditional targets for two countries: Algeria (4.1%) and Bosnia and Herzegovina (3.8%)" and that "only three of the top-20 flare countries fall to near 1% NDC target." (Elvidge et al. (2018; p. 158).

Nigeria is 7th among the top-20 flare countries. My calculations showed that Nigeria's flare reduction goal is closer to 40% of its NDC. Such a discrepancy calls for at least a revision of Elvidge et al. position as to the potential role of associated gas in meeting NDC targets. Of course, we would need to adjust for Nigeria's ambition in such a revision.

However, the above also shows the need for more direct engagement with national priorities in the global climate change mitigation and transition to 1.5°C sustainability pathways. Moreover, the barriers of dysfunctional incentivisation and lack of gas identity show that calls to have better gas governance goals in Nigeria have not been heeded (Adeniji, 2012; Akinola, 2017). While the mismatch in political and investment cycles is a common challenge of global democracies, there is a Nigerian angle. Deep-rooted barriers make it difficult to secure investors' trust for gas infrastructures (Thurber et al., 2011; Pérouse de Montclos, 2014).

Combining both abstraction levels showed gaps between the associated gas-related goals of the Nigerian government and international donors who are divesting from fossil fuels (Pauw et al., 2019; OECD, 2019; GOV.UK, 2020). Nigeria's NDC is 40% linked to associated gas commercialisation. However, international actors are divesting from fossil fuels. As a result, they are not investing in building capability for using Nigeria's associated gas. Therefore, there could soon be struggles on whether climate action involves better gas use in the COP 26 debates: as seen in the content of Nigeria's statement at the event.

In such debates, the interest of stronger actors does prevail through discursive switching (Rosenbloom, 2018). My findings contribute to the calls for more social science research on climate change for just transition and map a research agenda (Fankhauser, 2019; Falkner, 2014).

A more significant concern for goal coherence is that the proposed four targeted policy solutions are partially or wholly dependent on the politics of sponsors (global) or hydrocarbon (Nigerian). While an origin like the politics of sponsors may seem insurmountable, they could be mitigated. The initiatives need better horizon scanning to intelligently coordinate, steadily communicate and have a shared sense of purpose to generate impact (Najam et al., 2006; Fenhann et al., 2018). My findings suggest prioritising three of the four policy solutions to enable goal coherence at both levels, starting with intelligent coordination and regular communication.

At the global level, the actors could draw on the strength of their sponsors to orchestrate more coherent goals (Najam et al., 2006; Hale and Roger, 2014). A (presumably) common logic is that global initiatives could meet more often to communicate steadily and intelligently coordinate goals for a sense of mutual direction (Najam et al., 2006; Oberthür, 2009;). However, this is countered by the existing practice of siloed secretariats and administrative processes (Oberthür, 2009, p. 379).

At the Nigerian level, while advocacy for better incentivisation and increased access to gas-for-cooking is a possible solution, these are partially dependent on gas-specific legislation, which is missing (Nwapi, 2020). For example, there is a 20-year delay in passing the Nigerian petroleum industry bill at the Nigerian level. While a lack of gas-specific legislation drives a low gas utilisation (Adeniji, 2012; Oladipo et al., 2018), we know it also leads to a lack of identity for gas. Therefore, while there seems to be no way forward, my results in making a case for reality helps strengthen the existing literature (Ajugwo, 2013; Akinola, 2017; Oladipo et al., 2018; Nwapi, 2020).

Notably, increased financing is needed to make Nigeria's associated gas flare governance goals more achievable (Giwa-Osagie and Ehigiato, 2015; Mitchell and Marcel, 2015). However, financing seems inaccessible due to divestment from fossil fuel and little mitigation financing (Pauw et al., 2019; OECD, 2019; GOV.UK, 2020). Thus, the existing financing support supplied to the DCC is an opportunity to work better for coherent goals from the global level and ensuring Nigerian actors can do the same.

It is essential to consider gas-rich countries with energy gaps in planning 1.5°C sustainability pathways (Rogelj et al., 2018; Elvidge et al., 2018). Multiple studies show the importance of gas for Nigeria (Ajugwo, 2013; Giwa-Osagie and Ehigiato, 2015; Akinola, 2017). With its gas/flaring credentials (GGFR, 2020; IEA, 2020b) and projected population growth (UN, 2017), Nigeria could have an essential voice in these debates.

In addition to the systemisation of associated gas flare governance, my thesis makes contributions to the literature in at least three ways. First, by systemising associated gas flare governance goals, I have applied environmental governance concepts in gas governance (Najam et al., 2006). Second, I also showed that there are contending realities towards securing coherent associated gas flare governance goals. For example, the politics of sponsors (Biddle and Koontz, 2014), strategic fields (Fligstein and McAdam, 2015) matter for coherent goals. Besides, design, pragmatism and framing (Morrison et al., 2019) need to be dealt with to have coherent goals. Finally, in agreement with Najam et al. (2006) and Fenhann et al. (2018), I propose taking stock of progress against the goals of the global associated gas flare governance initiatives.

7.3 (In)effective instruments of global and Nigerian associated gas flare governance

As captured in **Figure 7-2**, the second major finding is that eight significant barriers originating from seven root origins constrain the articulation of instruments at both abstraction levels. Again, these findings may be new insights as earlier environmental governance literature (Bemelmans-Videc et al., 1998; Paavola, 2007; Oberthür, 2009). Besides, such insights were missing in the gas governance literature (Ajugwo, 2013; Giwa-Osagie and Ehigiato, 2015; Nwapi, 2020).
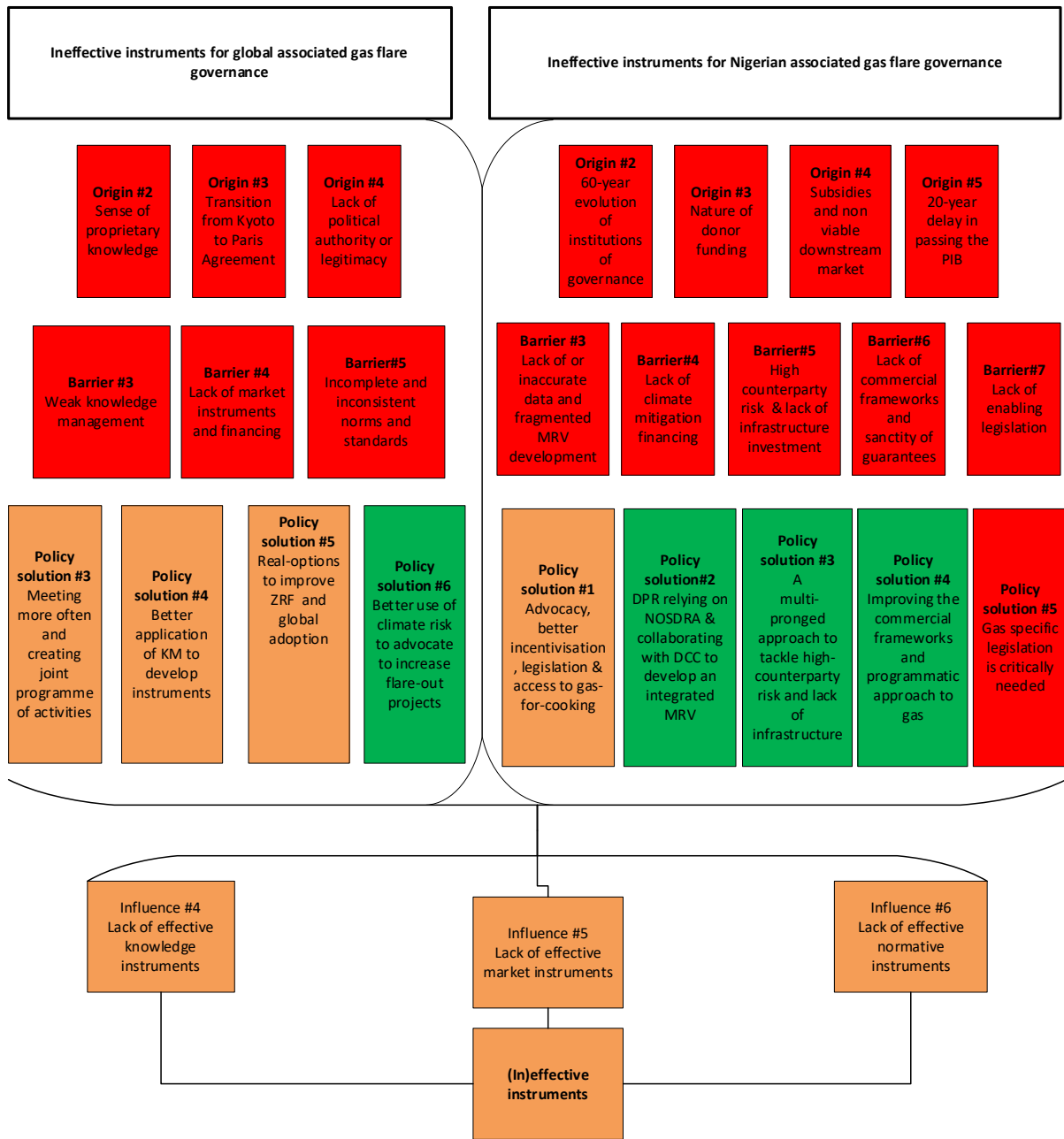
Figure 7-2 Origins and barriers to effective instruments and policy solutions

Source: Author

A sense of proprietary knowledge seems to drive inefficient knowledge management processes at the global level (Chasek et al., 2011). It also limits the initiatives' ability from combining resources to create standards as precursors to norms (Oberthür, 2009).

While the transition to the Paris Agreement and its attendant challenges for financing may be new, a held belief (by the initiatives) of lack of political authority is a point of agreement with Oberthür (2009).

Besides, I was able to show the market challenges for UNFCCC method number AM0009 caused by the transition from the Kyoto Protocol to the Paris Agreement in **section 5.3.2.2**. However, it does make a case for reconceptualising gas governance (Paavola, 2007).

At the Nigerian level, earlier researchers have covered subsidies, non-viability of the downstream (electricity) market and a 20-year delay in passing the Petroleum Industry Bill (Adeniji, 2012; Giwa-Osagie and Ehigiato, 2015; Oladipo et al., 2018). However, I make new contributions to the literature on the nature of donor funding and its challenges.

Understandably, donors are reluctant to fund fossil fuel projects (OECD, 2019; Pauw et al., 2019; GOV.UK, 2020). However, these contribute to gaps in the current climate negotiations. These gaps include mitigation finance, the role of gas in decarbonisation, Nigeria's reserves and its flaring credentials. A better understanding of what these gaps mean may also mean better progress towards climate mitigation targets.

There are connections between the three barriers at the global level and the five at the Nigerian level. First, global initiatives prefer knowledge and market instruments over normative instruments (Oberthür, 2009). However, there seemed to be no signs of older initiatives (GGFR and UNFCCC-AM0009) preferring market instruments and newer ones preferring normative instruments (Bulkeley et al., 2012). Second, a weak knowledge management process, which is a problem in other environmental governance areas (Chasek et al., 2011), reduces the effectiveness of knowledge instruments. Third, international donors supporting the Nigerian DCC with apparent gaps to national priorities may worsen existing knowledge and market instrument barriers. Thus, we could surmise that Nigerian gas governance instruments in their current state are unlikely to be effective. However, the role of the international actors in supplying conditional financing is yet unclear (OECD, 2019; Pauw et al., 2019; GOV.UK, 2020).

Despite a preference for knowledge and market instruments, there are hardly any active market instruments as AM0009 is suffering marketability challenges. Therefore, in addition to the volatility of gas prices and the sovereign risk of infrastructure investments, gas investors are potentially being asked to deal with increased carbon market risk in monetising gas as part of global climate action (Wood et al., 2012; Mitchel et al., 2015; Giwa-Osagie and Ehigiato, 2015; Adewuyi et al., 2020). Indeed, the global initiatives could use the consistency of standards as a solution; it is in their nature to govern through norms (Oberthür, 2009).

The barriers for effective instruments at the Nigerian level appear to be more deep-rooted in their connections but reaffirm existing barriers while offering new insights. For example, a lack of climate financing, infrastructure investments, commercial frameworks and legislation have been covered in earlier research (Nwanya, 2011; Giwa-Osagie and Ehigiato, 2015; Mitchell and Marcel, 2015). However, a lack of accurate data/fragmented MRV, lack of climate mitigation finance, high counterpart risk and lack of sanctity of guarantees are potentially new insights. For example, a lack of climate financing exists in the Nigerian gas commercialisation programme.

The barriers of inaccurate data and the fragmented development of MRV highlight two concerns. As a gas regulator, the DPR is not collaborating with the DCC as a climate regulator or using independent and potentially accurate data supplied by NOSDRA. Besides, the international actors may be complacent in worsening governance instruments challenges by funding DCC's development of an MRV and potentially not encouraging Nigerian level collaboration.

Notably, four of the nine targeted policy solutions could be implemented without dealing with the politics of sponsors or enacting primary legislation. In addition, there are already calls for better use of climate risk in governance. For example, Taskforce and Climate Disclosures enforces better climate risk reporting, which could be used to advocate for increase flare-out projects as a risk management measure (TCFD, 2021). Besides, the literature has highlighted an abundance of standards to deal with GHG from the gas sector. For example, the UNFCCC AM0009 is also a standard for the carbon markets.

I posit that this is a reconceptualisation of institutions of associated gas flare governance as was argued for environmental governance (Paavola, 2007) to focus on what matters – climate risk. Regular meetings and better knowledge management have been suggested as solutions for better environmental governance instruments (Oberthür, 2009; Chasek et al., 2011). I propose adding real options to ZRF principles to effectively deal with the uncertainty of the underlying asset in governing flaring and associated gas.

Apart from the findings or the need for a gas-specific legislation that is an existing insight (Nwapi, 2020), others may be new. Three are implementable at the Nigerian level. For example, I suggest new insights in regulators working together (DPR and DCC). Donors could advocate and encourage such a process so Nigeria can have an integrated MRV system. Perhaps what is also more interesting is the suggestion for reducing the government as counterparty risk.

My findings make four contributions to the literature.

First, I took forward existing insights from environmental governance authors in their applicability to associated gas flare governance, learning from and contributing to environmental governance (Bemelmans-Videc et al., 1998; Paavola, 2007; Oberthür, 2009; Bulkeley et al., 2012; Hale and Roger, 2014).

Second, my thesis has carved a newer path in our understanding of instruments of associated gas flare and environmental governance. I did this by tracing the barriers to origins, deciding their significance and root factors, and supplying prioritised solutions.

Third, I have shown that 40% of the savings from Nigeria's NDC links to associated gas. This insight is both a risk and an opportunity; Nigeria could play a vital role in global sustainability pathways due to its population projection and energy insecurity. Fourth, another possible new result is the high counterparty risk posed by Nigerian government agencies as consumers of gas-to-power. My thesis also brings in newer insights into the lack of sanctity of agreement and how this negatively affects gas identity and the resultant lack of infrastructure investment.

Nigeria has issued a challenge by setting up an ambitious target on what to do with its associated gas resources to deliver sustainability pathways. It is now up to the international community to accept the challenge and help it secure the instruments needed to deliver the target. My working assumption was that there is international mitigation financing for conditional NDC.

However, through my thesis, I have repeatedly challenged my naivety of available climate finance. For example, the divestment from fossil fuel projects and the lack of direct financing are examples of a lack of international mitigation finance (Elvidge et al., 2018; Pauw et al., 2019; OECD, 2019; GOV.UK, 2020). However, financing must be found to make progress towards a 1.5°C sustainability pathway.

7.4 (In)efficient processes of global and Nigerian associated gas flare governance

As captured in **Figure 7-3**, the third major finding is that five significant barriers originated from a lack of systems thinking. These barriers constrain both the global and Nigerian associated gas flare governance abstraction levels. The global initiatives are not coordinating their activities or collaborating with their Nigerian counterparts to make the most use of associated gas. Therefore, better associated gas flare governance could be challenging.
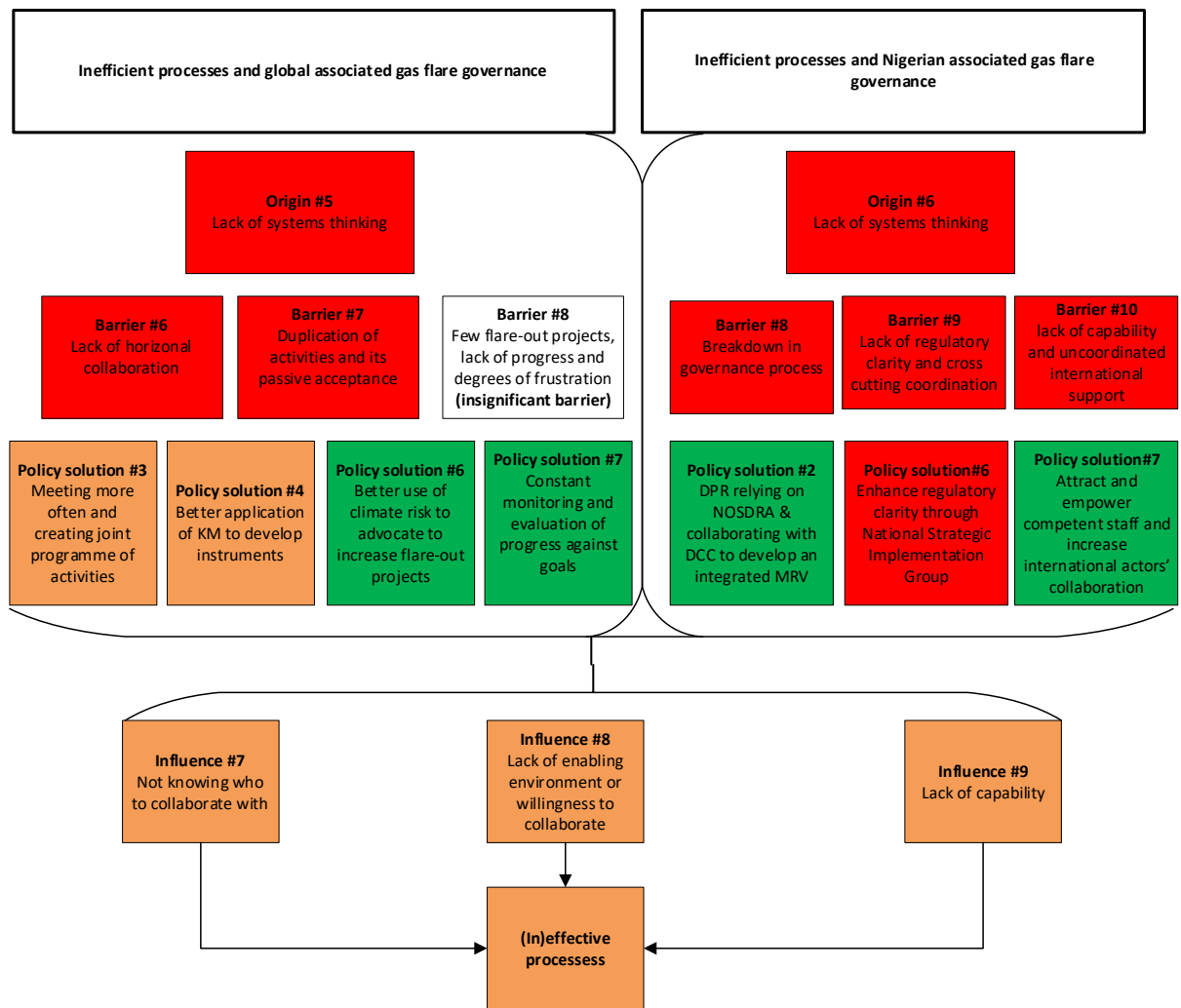
Figure 7-3 Origins and barriers to efficient processes and policy solutions

Source: Author

At the global level, lack of horizontal collaboration and duplication of activities is usually passively accepted as the price paid for development-related work (Najam et al., 2006; Bulkeley et al., 2012; Fenhann et al., 2018). However, my findings of degrees of frustration and few flare-out projects compared to the scale and complexity of the global flaring challenge take this in a new direction. In addition, researchers have alluded to a breakdown in the Nigerian hydrocarbon governance process (Thurber et al., 2011; Oladipo et al., 2018; Akinola, 2017).

However, I supplied a specific context but linked it to the 60-year development of Nigeria's institution of gas governance. Researchers have also referred to the lack of regulatory clarity as a challenge for Nigeria's associated gas flare governance (Akinola, 2017; Nwapi, 2020). My thesis shows how these problems continue with more recent and specific examples. In addition, I supplied clear examples of

how a lack of capability and the uncoordinated approach by the global initiatives may be making the challenges worse for Nigeria's gas governance system.

Four of the seven suggested policy solutions are implementable. They are neither partially nor wholly dependent on the politics of sponsors or gas-specific legislation. Furthermore, while solutions such as meeting more often and creating a joint programme of activities might sound cliché, they could be prioritised and implemented in the short term.

We do indeed owe it to the integrity of the UNFCCC process to assess the effectiveness of global climate initiatives (Fenhann et al., 2018). This process starts with the monitoring and evaluation of the activities and progress. It is within the power of Nigeria's executive arm of government to ensure DPR relies on NOSDRA data and collaborates better with DCC to deliver the NDC targets. However, it would be helpful if the global actors advocated for such an action and did not hinder it by contributing to a lack of systems thinking.

I posit that there are at least two areas of interest for effective governance processes.

First, there are fewer contending governmental departments at the global level than at the Nigerian level. However, sponsors want different things, putting the global initiatives at odds (Omri and Mabrouk, 2020).

Second, while the global initiatives are not working together (UNFCC and GGFR met last in 2010), there is a passive acceptance of this barrier (Oberthür, 2009). However, this passive acceptance could be challenged (as my interviewees-employees of the initiatives did). A counterfactual is the "fear of moving at the pace of the slowest". Moreover, I do not assume that the initiatives are coherent within themselves. After all, initiatives comprise individuals who also have their politics and agendas, which is worth mentioning.

My results showed Nigeria has multiple gas regulators, agencies, departments and ministries. These multiple regulators are the first hurdle to contend with for efficient processes and knowing whom to collaborate with for better associated gas flare governance. Nevertheless, we can generally have independent and partnership processes and orchestration as ways of working (Oberthür, 2009; Hale and Roger, 2014). Besides, authors have discounted a world environmental organisation (Perrez, 2006; Paavola, 2011). However, it may be time to consider new approaches to efficient processes of associated gas flare governance.

As stated in **section 3.4.6**, I have compared my findings with the literature. Through this process, I suggest three new process-related analytical frameworks as my contributions to the literature.

First, efficient processes could be about knowing whom to collaborate with and tackling the significant barriers that negatively influence this at both the global and Nigerian levels. I found that of the five initiatives, the knowledge of whom to collaborate with was either lacking or incomplete. While this might not be entirely the case in Nigeria, the second insight applies.

Second, an efficient process is about the enabling environment and willingness to collaborate. At the global level, it was clear that the politics of sponsors and a sense of proprietary knowledge contributed to this barrier. At the Nigerian level, a breakdown in governance processes could be linked to allegations of corrupted processes. It could also be linked to self-interest, which means neutering policies in conceptual phases (Thurber et al., 2011; Pérouse de Montclos, 2014; Adeniji, 2012; Akinola, 2017). Nigeria's adoption of the Norwegian model could supply clarity for gas governance, assuming it addresses critical challenges and adopts the fundamentals of the model (Al-Kasim, 2006; Thurber et al., 2011).

Third, efficient processes also involve the capability to collaborate. While it was not clear if this was a challenge at the global level, it is a problem for the Nigerian level and has multiple implications. These implications include knowing how to govern associated gas flaring through the right balance of knowledge, market and normative instruments, and coherent goals. Indeed, there could be a lower chance of having coherent goals and effective instruments for better gas governance without efficient processes. Furthermore, we stand a smaller chance of developing socially relevant societal associated gas flare governance for the needed just transition (Fankhauser, 2019).

7.5 Future of Nigeria's associated gas flare governance, COP26 and global complexity

7.5.1 The future of Nigeria's associated gas flare governance

The analysis of barriers and evaluating targeted policy solutions for the Nigeria part of the gas governance system points to two future scenarios. **The first scenario is one with** competency staffing of government agencies and departments, driving change and governance rather than politics. T**he second scenario points to the status quo with hydrocarbon politics** continuing to drive change,

staffing decisions and governance. However, the insights presented so far point to the likelihood of scenario two. Two interviewees supplied this insight:

"Unless there is a shot of blood to the brain, the status quo would remain the same. The thinking, leadership and governance approach must change so that Nigeria starts to hire civil servants based on expertise and to empower them to act" (NGN1).

"Nigeria is unlikely to deliver on its gas-based industrialisation plans, which could lead to seeing gas in our transportation, housing, and industry. To have gas-based industrialisation, we would start hiring regulatory staff to higher offices based on competency. This approach could ensure stronger regulatory agencies. Better regulatory agencies can help move the gas sector towards achieving many policy actions from the National Gas Policy of 2017. However, the evidence points otherwise" where we cannot even get market-based pricing and economic regulation right" (NGN2).

7.5.2   Nigeria's position from COP26 and associated gas flare governance

For Nigeria, the problem and solution are indeed about Sustainable Economic Transition. Notably, the United Kingdom as an international partner is helping Nigeria to strengthen its governance system. The UK could consider Energy Access, UK Businesses, Influencing EU Partners, and International Partners to increase UK power but lead to sustainable goals as suggested.

Energy consumption patterns or the reason for ending flaring have led to hard positions in the COP negotiations as highlighted by the Nigerian position in its national statement during the World Leaders Summit at COP26 in Glasgow: The Nigerian President said:

"Nigeria is actually more of a gas than an oil producing country. Consequently, I am requesting for financing of projects using transition fuels such as gas. Nigeria has developed a detailed Energy Transition Plan and Roadmap based on data and evidence. This plan has highlighted some key facts that faces the difficult conversations. Our transition plan also highlights the key role that gas must play in the transition of our economy across sectors; and the data and evidence show that Nigeria can continue to use gas until 2040 without detracting from the goals of the Paris Agreement". (*Transcript of President Muhammadu Buhari's speech at COP26 World Leaders Summit – Tuesday 2nd November 2021*)

Resolving and reconciling such hard stances like that of Nigeria in continuing to use its associated gas until 2040 while committing to the Paris Agreement are critical international diplomacy and negotiations and implementation actions to follow from COP26. Notably, the Nigerian President did not comment on agreements to be reached at COP26 (perhaps referred to as "Glasgow Agreement).

7.5.3   Global complexity of measuring flare emissions

The problem started off with flaring, is it has become more than flaring and without findings a solution to measuring flaring emission, we are adding fugitive emissions to the mix and in danger of adding further emissions and initiatives to an already complex situation. There seems to be a broader problem which comes back to the basic issue of knowledge instruments and a lack of a common process for measuring and certifying flaring emission and not conflating the issue with other types of emissions.

My research looks at flaring and many organisations and actors are engaged in recent initiatives because we have discovered fugitive emissions – partly because of the problem of failed production in North America (see Rutherford, et al., 2021 for example). Flaring Emission are different from fugitive emission and again there is a risk of further confusing the matter through discursive switching and fragmentation (Beunen and Patterson, 2016; Morrison et al., 2019). It goes even further than that because in the liquified natural gas Industry, there is talk about certifying levels of carbon intensity in LNG Cargos (see Stern, 2019 for example).

While the debate for Nigeria is whether and how it uses its gas for regular energy conversation cycles into electricity and other commercialisation ventures, developed countries argue about blue versus green hydrogen and using natural gas. There are research insights saying that the hydrogen from gas is worse than using the gas itself because of the CCUS (Yu, et al., 2021) and we need to pause to reflect before drawing global-scale conclusions.

We have a problem in the oil and gas industry production that fugitive emission and flaring exit, but customers want to increasingly know the carbon intensity of the products they are buying, and both flaring, and fugitive emissions contribute to the carbon intensity. Oil being produced in a system with little to no measurement of flaring levels is going to have a higher level of carbon intensity than one that does measure flaring levels – which is closely regulated.

At a basic level, the debate comes back to measurement but the decision as to what is included in measuring flare emission is a key governance decision that borders on discursive switching where

power actors change the narrative to suit their needs. At the international level, only GGFR and ZRF 2030 are actively in this space – but the likes of OGCI are trying to boil the ocean, include increasing levels of emissions which means discursive switching could be making the problem worse.

7.6 Summary of chapter seven

My findings are that they may be two partially connected systems of gas governance at the global and Nigerian levels. However, significant barriers and root origins meant incoherent goals, ineffective instruments and inefficient processes, mean the system that is yet to be viable. The results were somewhat disappointing for two reasons.

First, targeted policy solutions were either partially or wholly dependent on the politics of sponsors at the global level and on gas-specific legislation at the Nigerian level. Notwithstanding, the solutions are helpful as they could be sequenced to work around these root origins. Second, a sequenced approach means that the actors can first show relative "quick-wins" with these in place. There could then be a more compelling story to implement the remaining solutions blocked by root origins. However, the originality of my research partially explains the disappointing results. While the global level is big-picture oriented and siloed, Nigeria has its challenges in cross-cutting coordination. The in-depth analysis of significant barriers and policy solutions, including the prioritisation and sequencing, lends credibility to the above suggestion.

What the results show are opportunities to indeed "go beyond incremental climate action, to society-wide transformative climate actions" (Gillard et al., 2016, p. 252). However, there are unresolved issues. On the one hand, the global demand for gas increases annually (IEA, 2020), ending associated gas flaring is a critical factor in enhancing NDCs (Elvidge et al., 2018). Developing countries are dependent on it for emission reduction (Fernando et al., 2019). On the other hand, we expect emission growth from developing countries to increase gas consumption for basic and industrialisation needs (Rogelj et al., 2018). At the same time, developed countries (i.e., the UK) plan to use gas to bridge decarbonisation (CCC, 2018). However, these developed countries need CCS and robust strategies (McGlade et al., 2018).

While the financial case is glaringly apparent, there are no apparent coordinated efforts to pool and leverage the existing financing resources. The estimated cost of ending global flaring is $100 billion. Nigeria needs $142 billion in climate finance but loses close to $1.63 billion annually to flared gas. All these are cases that could lead to action, but this does not seem to be happening. While the World

Bank is ready to de-risk and finance start-up lifecycles of flare-out projects, there could be better coordination. Coordination could be with OGCI that has a $1 billion war chest. Coordination could also be linked to the claim of GMI to have raised $600 million for methane reduction projects. Finally, coordination could be between all three or more initiatives to raise the finance needed.

From the above, we can assume that global and Nigerian associated gas goals, instruments and processes exist but are not yet matured. The World Bank created GGFR in 2002 as the first global associated gas flare governance initiative. If the global initiatives are not collaborating, they stand a lower chance of influencing national associated gas flare governance actions to tackle flaring effectively. Rather than get caught up in the view that the system does not reach the needed viability, this is an opportunity to make the systems better while still at a nascent stage (Najam et al., 2006; Fenhann et al., 2018; Hale, 2020).

Indeed, the Nigerian associated gas flare governance could include a single regulator and prohibitive sanctions, fostering an enabling regulatory environment and applying better economic understanding to the value chain (Banerjee and Toledano, 2016). It should also be about connecting the dots and using the global level to shape the national level.

Chapter 8   Conclusions and recommendations for future research

8.1   Introduction to chapter eight

As promised in my aims and objectives **section 1.5** I systematised the global and Nigerian associated gas flare governance in **Chapter 4** to **Chapter 6**. **Chapter 4** was my first attempt to systematise the global and Nigerian associated gas flare governance individually and as a connected system. However, as shown in **section 4.5**, emerging barriers made this a nonsensical system, which was not viable. Viability meant coherent goals, effective instruments, and efficient processes for tackling flaring and optimally using the 1.5°C sustainability target.

Chapter 5 traced the emerging barriers to their manifestations, origins and influences, supporting the findings of a lack of viable governance system. **Chapter 6** offered targeted and sequenced policy solutions to tackle the significant barriers, root origins, and shift the systematised global and Nigerian associated gas flare governance towards minimum viability.

This chapter discusses the findings and engages with literature. In **section 8.2,** I highlight the findings. **Section 8.3** draws out the implications. **Section 8.4** highlights my contribution to social science and policymaking. In this section, I recommend future research. I reflect on the qualitative rigour and my growth as a researcher and further growth opportunities in **section 8.5**. Finally, **section 8.6** is the conclusion to the chapter.

8.2   Findings for the systematised global and Nigerian associated gas flare governance

Most of the literature reviewed highlighted the problems of associated gas flare governance without precisely tracing their manifestation or proposing solutions but not solutions. While my thesis is about better associated gas flare governance, climate action is one of the influences on systemising and institutionalising its governance. Flaring is the burning of gas associated with oil extraction. It is also a colossal global waste and environmental challenge. Therefore, there needs to be a mapped and connected multilevel system of associated gas flare governance, no matter its viability, which my thesis has supplied. By adopting this approach, I have made contributions to policy frameworks and knowledge gaps.

Overall, I found a system of governance that has been fragmented over the 2-3 decades of its existence, not taken as seriously as it should and there are simple solutions that can start nudging the

system towards minimum viability, with at least some form of coherency in goals, effectiveness in instruments and efficiency in processes. My solutions would have been better if I had the opportunity to go back to the actors and tested it with them to enhance the chances of their implementation. The thesis suggests sequencing and prioritising the solutions; it supplies a before-and-after view of the systems' viability after applying the solutions.

While commensuration matters apply, and international actors may go beyond arguing to end flaring to argue to end the consumption of fossil fuel; this complicates an already complex governance space, and such contentious matters are left out of the thesis. I argue that we need to systematise the governance of flaring before progressing to deal with more complex issues as to who pays and how far-reaching nature of the system.

Systematising the global and Nigerian gas flaring governance system is a storyline which resonates with multiple experts and stakeholders, but the dots can be connected through systems thinking. To an energy system expert, an increase in global gas consumption from 21% to 23% between 2010 to 2019 means its consumption has not declined and it is relevant in the future energy mix. To a macro, geopolitical energy governance expert, gas consumption is a tale of two halves.

Developed countries such as the UK want to use gas for to create hydrogen, which is fancy and seems futuristic but depends on carbon capture, usage and storage (CCUS) to be successful. At the same time, you have developing countries like Nigeria where a large proportion of the population do not have access to electricity (48% or 70 million) and clean cooking facilities [90% or 170 million) of which gas is a solution, which means the issue of stranded assets is a key risk. Therefore, we can surmise that the problem is two-fold at the global and Nigerian level with an overarching view.

A system to govern associated gas flaring could be extended to govern gas use as a broader concept if it attains minimum viability. Such connectivity could be achieved by clearer conditionality of funding: when international donors give Nigerian regulators money to strengthen their governance system, what they are interested in, is the reducing in GHG benefits and this could be achieved through gas commercialisation benefits which is what Nigeria is interested in.

At a global level, it is about gas flaring as a global problem contributing to GHG. we have identified that flaring from oil production is a source of GHG and a waste of a valuable resource – methane which could be captured and used as an energy source. So, the international governance of flaring issue is

around several initiatives to target and reduce flaring. This is a fragmented landscape, with competing initiatives trying to do the same/different things.

While there are goals, instruments and processes for associated gas flare governance at the global abstraction levels, these were not coherent, unconnected and viable. It looked like institutional partnering at the global level would not deliver the day, as the global initiatives are severely constrained and undermined by the politics of sponsors. However, practical prioritisation and sequencing of the solutions theoretical enabled better collaborative processes. Besides, practical prioritisation enhances better connectivity of critical associated gas flare governance goals to SDG benefits.

At the Nigerian abstraction level, goals, instruments and processes were developed over 60 years of gas governance institutionalisation. However, there are significant gaps for a viable associated gas flare governance system. On the one hand, incoherent goals and ineffective instruments meant gaps in meeting the 40% gas linked NDC target. On the other hand, a lack of cross-cutting coordination and clarity in gas regulation mean a lack of progress. However, despite the lack of enabling legislation, some policy solutions could lead to better progress. These included global actors advocating for better collaboration and the DPR collaborating better with the DCC. The global actors have a role in ensuring better collaboration through their support for capability building at the DCC and do this through multiple lenses including energy consumption.

At the Nigerian level, it is true that Nigeria is contributing to the global problem of flaring, but this problem is also feeding into the domestic challenge to capture and use the methane rather than flare it: through commercialisation and use it as an energy resource. Perhaps the use could be in power generation, providing fuels for clean cooking or maybe small-large scale liquified natural gas.

Collectively: the problem here is governing GHG from flaring and realising in the Nigerian context; the process of commercialisation which links quite clearly the NDC for Nigeria to achieve 40% of its NDC targets and become a gas-based industrialised country. Therefore, the global and Nigerian system, when mapped could be connected through a win-win scenario.

8.3   Implications for global and Nigerian associated gas flare governance

The framing for the PhD piece is important as when we get to the national situations, gas flaring and the reason it is not being used are intertwined and we need to walk a tight rope between

acknowledging the interlinked system without being too diverted by the whole of the gas governance issues including a lack of functional market. However, we need to highlight issues of broader governance that stifle initiatives to end flaring.

Therefore, the implications of the findings of this thesis are about associated gas flare governance in Nigeria which requires actions that could benefit broader gas governance and use. While I acknowledge that the problem is about better governance of associated gas flaring, it is also about better gas use and governance but there are too many things to consider, and this PhD focuses on flaring and when the wider issues are considered, they are to add context rather than widen its coverage.

My findings have three implications for the now systematised global and Nigerian associated gas flare governance system. These implications include insights on reframing and institutionalising associated gas flare governance goals for coherence. It also includes the range of knowledge, market and regulatory instruments: but also, who pays to end associated gas flaring. Processes are critical as the bedrock of governance.

8.3.1   Reframing and institutionalisation of associated gas flare governance goals

Reframing associated gas flare governance goals and creating new purpose

At the international level, there is a lack of specificity in tackling the problem of flaring among associated gas flare governance actors and this problem may arise from the politics of sponsors but involves discursive switching. The resource curse complicates the problem of lack of goal coherence at the Nigerian level and it is likely to get worse here.

However, discursive switching could be helpful to national actors who want to include many aspects of the problem of associated gas flare governance in climate actions and the financing required. So, international actors in helping Nigeria could use more systems thinking.

This might mean they invest more to strengthen its associated gas flare governance arrangements instead of debating whether they invest or do not invest in fossil (see **Table 4-14** for the international actors offer of assistance to the Nigerian Department for Climate Change (DCC)). Such an intervention could be framed as captured in **Table 8-1.**

Table 8-1 Implications for changing narrative and reframing of associated gas flare governance

Solution	"Carbon Reduction Strategy" "Not a Fossil Fuel Use Strategy" – let the commercialisation side take care of itself, because it is how you pay for the solution.
Purpose	It is to reduce GHG from flaring and or fugitive emission and this is the service of the global initiatives and Nigerian actors which could be bound together through social action and enterprise.
Who pays	The actions of creating gas pipelines should be paid for through the commercialisation of associated gas. The intervention suggested by this thesis should be focused on helping to make real the system of goals, instruments and processes that would make associated gas use self-financing.
Change in narrative and framing	The actions of the international actors and financing they provide will help in systems creation and strengthening (but you could argue this is a chicken and egg situation) with conditionalities attached. However, helping Nigeria reduce its GHG from flaring and helping Nigeria create a system where it can make better use of its associated gas resources to meet SDG goals and are the same – and tackle climate change. The change in narrative is needed in framing the problem. Besides the associated gas flare commercialisation could pay for some of the future advanced energy and technology solutions that have been touted about.

Source: Author

Associated gas consumption failure and opportunities to strengthen governance

Lest we forget the Nigerian electricity market is bankrupt and the solution could also include gas-to-cooking which has less bankruptcy risk than gas-to-power (see the domino effect for the electricity sector – covered in sections **5.4.2.3** for the manifested barrier and **6.3.1** for the accompanying solution). Gas-to-power solutions could be micro-grid solutions to de-risk them from the bankruptcy of the electricity sector. The bigger problem for Nigeria is "How can you have a gas commercialisation strategy when you don't have a functioning market for gas consumption to generate electricity and you don't strengthen the other consumptions modes – gas-to-cooking or micro-grids"?

Creating a functional market is a big challenge for systematising and better associated gas flare governance and the likes of the global initiatives and actors are hugely invested in the problem. However, they can help with the solutions in the rethinking and reframing needed. They told Nigeria to privatise associated gas commercialisation but now need to come through to strengthen the system to enable the commercialisation through enabling coherent goals, effective instruments, and efficient processes at both the global and Nigerian abstraction levels.

The global initiatives could work with the states in Nigeria for micro-grids as the electricity infrastructures are not fit for purpose and engage more with the states within the rules of the game, while helping to strengthen associated gas flare governance at the national level. This solution is part of the bigger conversation about delivering energy access in sub-Saharan Africa which is not about building bigger national grids.

8.3.2   Deconstructing the associated gas flare governance instruments

Who pays? The opening gambit – Nigerian national statement at COP26 and Corporate Venturing

Who should pay for the solution to end flaring? As a member of the public, we would ask a couple of questions – what is the problem? The problem is oil companies produce oil and flare natural gas and they should not be doing this, so why should we pay them to stop flaring? If we are better informed, we talked about the commerciality angle and the fact that this is a valued added resource and commercialising it can generate income to stop the flaring.

However, this is a classic externality problem is contributing to climate change challenge and the cost of flaring is not reflected in the cost of crude oil. You could slap a big tax on crude to pay for the externality, but the challenge is – this is an externality, it is identified, it is measurable, there is a cost of capture and use but we have already known that the oil companies claim that if they are over-regulated, they would not produce much oil. So, from the perspectives of the public, we do not want to pay more for our energy, but we are beginning to understand that the consequences of climate change are becoming significant. So, my thesis talks about knowledge, market, and regulatory instruments – but how about the politics of who pays?

Interestingly one of the newsworthy corporate events from oil companies in Nigeria, on the 2nd of November 2021 (same day as the Nigerian Presidents statement at COP26) was an announcement by Shell "unveiling a new energy business to capture and use its associated gas to help Nigerian's tackle energy security challenges"[1].

A sceptic might connect the dots between the Nigerian President's statement and this corporate venturing. However, I am optimist and pragmatist, and my starting point is seeing these events as

---

[1] https://businessday.ng/energy/oilandgas/article/shell-unveils-new-energy-business-line-in-nigeria/

opportunities to reframe goals but also re-visiting the question of who pays by re-examining what the conceptual frameworks of knowledge, market and regulatory instruments tell us about effective governance instruments and what they mean for associated gas flare governance.

Polluter pays principle and associated gas flare governance instruments – the way forward

While "Polluter pays" is a great principle, the devil is in the implementation details. See decades of struggles to answer the question on implementing a global carbon tax. Therefore, to answer the question of who pays, I propose that we need to deconstruct the parts of the associated gas flaring governance instruments.

Broad level view of who pays	→	More specific level view of who pays	→	Identify and evaluate existing mechanisms to reduce the burden of who pays
These three levels are too blunt and high to determine who pays	→	At this level it starts becoming clear that some global initiatives have simple mechanism and could work together to increase complex knowledge mechanisms including market and normative instruments	→	Created analytical memos and used this to frame the of the three associated gas flare governance instruments

Associated gas flare governance instruments

Knowledge instruments	Simple mechanisms Complex mechanisms	
Market instruments	Monetisation arguments Top-down market creation Bottom-up market creation	We need to deconstruct and reduce the levels of complexity and make use of existing mechanisms to repurpose them for better associated gas flare governance
Normative instruments	Command and control Hard targets Standard setting	

Figure 8-1 Deconstructed gas governance instruments to figure out who pays

Source: Author

Gaps in better knowledge management and who pays?

The systematisation of the global and associated gas governance knowledge instruments has shown that it can be deconstructed into simple and complex mechanisms. However, there is gap in applying the four (especially the fourth) process of sharing knowledge across global initiatives. At the Nigerian level, it was a case of hardly any knowledge instruments existed or they are the nascent stage.

Without the knowledge instruments to reduce cognitive barriers and enhance the decision-making process of "what to do with associated gas" global and Nigerian actors will struggle to end flaring. Therefore, a detailed mapping and taxonomy of the knowledge instruments can be conducted and matched to the application of the four parts of the knowledge management processes at the Nigerian level and refreshed for the global level. The implication of the current findings from this thesis is that Nigeria, supported by global actors and oil and gas companies pay for knowledge instruments to fill the gap of what is needed to have viable gas governance.

Instinctively and with the need for further research, the country and the international actors could pay for mapping out the knowledge instruments and the oil and gas companies could contribute significantly. This will ensure there are well defined knowledge systems that enable well-defined standards so we can have hard targets and command and control systems that could work in flare-out plans.

My proposed solutions cover the externality which arises due to imperfect information, split incentives and the usual suspects of externalities. Testing the solution for simple knowledge systems could involve sense checking the efficacy of AM0009 and its equivalents in incentivising oil and gas companies to put up debt and equity capital to finance flare-out projects. But we know AM0009 and CDM failed to some extent and there is a gap in lack of standards (regulatory instruments – which is left to the country) which could be filled by repurposing the likes of AM0009 in a world without the need to demonstrate additionality but jumping straight to implementation.

Gaps in market instruments and marketisation to pay.

So, when it comes to the question of who pays – the instruments need to be unpacked, to shift the opportunities from the oil and gas companies who will start chasing after the opportunities (see what is happening in the Nigerian commercialisation).

I argue that by seeking to immediately end fossil fuel consumption, we are trying to let the oil and gas industry off the hook for centuries of sins committed. There are players out there, outside the oil and gas companies who are willing to pay for commercialisation. See what is happening in Oman where the government says to the oil and gas companies "don't worry, we know your investors don't want to take the risk of monetising gas, we have investors that will take the risk off your hands" (this is already happening based on the experience of Flare-2-Value in Oman).

I posit that the shift in paradigm should be one where we are not looking to force the oil and gas companies to pay – it will take too long to achieve this result, they have expensive lawyers who can dance circles around host countries and hold them hostage. Instead, we should outsource the monetisation process. But see what is happening in Nigerian with the oil and gas companies becoming more interested in the gas commercialisation once the process started.

The question of who pays for the infrastructure could still be answered within the unpacking of the market instruments perhaps in the bottom-up and top-down space, but it also straddles the commercialisation question. Perhaps a smarter question is should we be focused on large scale solutions or could small scale micro-grid solutions which are less expensive be the way forward. But an event smarter question is what is the scale of consumption opportunities for gas-for-cooking and LNG compared to gas-for-power and what are the infrastructure cost comparable?

On the infrastructure part, it is less expensive to set up micro-grids and gas-to-cooking facilities, so why not prioritise these? And then the outsourcing firms could grow to become micro-grid energy providers? On the operational aspects, gas-for-cooking can be piped into small cylinders which are transportable over longer distance more conveniently. On the climate angle consider the fact that "Close to 150 million Nigerians lack access to clean cooking facilities, where containerised solutions could work" compared to "77 million who lack electricity" and the fact that "the downstream electricity market is bankrupt".

Now, I do not argue that electricity supply is not important but argue for triaging the critical problems and fixing them incrementally. See the work of Stakeholder Democracy Network who believe funding can be generated for gas-to-cooking from international donors and how to take this work forward. Besides according to the Stakeholder Democracy Network, the gas could be pipped to generate electricity in close-by communities.

The problem of lack of large-scale infrastructure is real as once you turn the molecules of associated gas into electrons the adequacy of the grid is still a problem, but it can feed into a local solution – small solutions are working; it is about containerised solutions. The difference between gas to power and gas to cooking is the user pays before they use it and Nigeria's growing middle income earners will pay for the gas to cooking.

The above comes under using systems thinking where there is a commercial solution that the paradigm can be shifted to create a more viable solution. The oil and gas producers themselves are not incentivised to find solution but we can make this open to others – see my solution on multi-pronged approach to be expanded into a system thinking approach to ending gas flaring.

These systems thinking is also part of a leap-frogging strategy where we are not going to create a mega national electricity grid or transmission systems; you are creating a smaller solution at regional local levels. Models could be built for 5-10-15 years with growth opportunity from excess capital generated from gas to cooking which can then be invested in micro grid for gas to power and getting rid of self-generation. You start with gas to cooking, making a profit, grow the company to get into micro-grid markets.

A further study could formalise these taxonomies to understand how the oil and gas companies, or other interested parties could be made to pay for the monetisation, how the top-down market arguments could be collectively made and how the oil and gas companies and other interested third parties could build markets for gas commercialisation bottom-up.

Normative instruments and regulation

As mentioned earlier, it is up to host countries to establish command and control systems assuming they have the means and international actors can help with the hard targets to make it workable while oil and gas companies could help with the standards without capturing the system. However, the global actors could do better by assisting with matured knowledge management processes to create consistent standards and norms.

A further study could also help formalise the taxonomies of normative instruments as command and control, hard targets and standards, but sense check how and why governments could continue and strengthen command and control and how international actors could help create and strengthen hard

targets. But it seems standards do exist already, and it may be a case of capturing and using these existing standards in better ways to end GHG from flaring.

8.3.3   Broad churches collaboration and efficient processes

The resource curse leads to all sorts of problems and Nigeria is a classic case of a country suffering resource curse which cannot manage the problems highlighted in this thesis. There is a higher order problem here which is all about extracting maximum value from rent. However, a lingering question is how you sell the policy solutions and the idea of leap-frogging energy systems strategy to potential sponsors-donors as investors.

From an SDG perspective the policy solutions are ticking lots of boxes and dealing with lots of problems – indoor pollution, energy access, quality of life, and others. A way forward is about making more of the fact that it is not about getting the oil and gas companies to solve the problem – the answer is perhaps in thinking about the problem differently with a systems perspective, supported by efficient processes.

The systems perspective is about getting the right actors into a room to expand the "what – solutions" into the "how-implementation plans" and I suggested this could be where we test solutions in little bit sizes and make them work. There might be further work required to map types of fundings available, how they can be used and whether such fundings can be used for fossil fuel projects. If the oil companies are excluded and we keep the beneficiaries are the ones the donors want to help we can generate seed capital from global initiatives to test and implement the policy solutions from this thesis.

As highlighted earlier, I developed and proposed three concepts for efficient processes of associated gas flare governance which include (1) knowing who to work with, (2) the enabling environment to collaborate and (3) the capability to collaborate. Therefore, it makes sense to draw out the implication of my findings for better processes from these concepts.

As an optimist, I believe there are still forces within the Nigerian and global system that if supported can lead to the change in paradigm needed (see places to intervene in a systems paper (Meadows, 1999)). Those who know the system best – can create and use the influence (Governance) to make things work as could be achieved by NEITI and FOSTER in Nigeria if properly supported.

There is a need for the climate and energy actors at the global and Nigerian level to talk to each other. The way forward is not to say we need to manage the oil rent, but it is to step forward to look at what associated gas commercialisation could do for climate change and SDG goals. You can take the gas commercialisation policy and tick all the boxes of what it can do and then take it away to implement. (See what the Global Fund did by bringing together the top-donors in Nigeria and how this can be applied to Nigeria. Before they spend money, they lean on expertise of each other Malaria – TGF, Children – UNICEF, Vaccine – GAVI; its starts with knowing who is in the system[2]).

It is important to bring in the Norwegian model which showed up as the processes used by Nigeria to manage its associated gas flare governance. But in these concluding sections, I highlight the question of whether Nigeria should be using the Norwegian model or if it is a useless endeavour.

Nigeria chose to adopt the Norwegian model to kickstart the associated gas commercialisation programme. My recommendations on efficient processes are ways of implementing the Norwegian model which requires adopting the fundamentals of policymaking. The Norwegian model is the theory, and the practice are my recommendations for efficient processes in Nigeria.

The Norwegian model can be implemented in three styles and Nigeria could have gone for the consolidation of roles instead chose to separate roles. While this is within Nigerian Sovereign rights, it is important to put the practical recommendations in place to support the chosen type of Norwegian model and make this implementable. These elements and fundamentals that need to be put in place start with the minimum requirements for the Norwegian model. The ideal endpoint is fully fledged associated gas governance system that connects industry and environmental regulators and regulation, but the incremental approach could be preferred.

8.4   Contributions and recommendations for further research

8.4.1   Contributions to social science and policymaking

I made the following contributions to social science and policymaking. First, I used goals, instruments and processes and conceptualised an associated gas flare governance system. Further work is needed to make such a system viable. However, my articulation theoretically enabled coherent goals, effective

---

[2] https://nscip.gov.ng/about-nscip/

instruments and efficient processes to protect the environment from flaring. Second, by using the goal, instruments and processes as concepts, in developed conceptual frameworks. Third, I considered ending flaring and increased gas use as a systems problem which showed practical solutions.

This is PhD research, and my contribution could indeed be more conceptual – in terms of how I have progressed academic work to consider the three concepts of goals, instruments and processes, how I applied them to systematise governance of associated gas flare and how to use the origins-barriers-influences approach to map out the barriers and find practical policy solutions. Academic work on environmental governance and the governance of associated gas flare need to consider the kind of issues I highlight in my two levels of abstraction.

I also showed how the current approach to global associated gas flare governance could be more cognisant of the national realities to reflect the competing narratives at national levels. For Nigeria, flaring and climate change takes different narrative values; they need energy security and economic growth. Perhaps we could make better progress through a reconceptualisation of associated gas flare governance. Reconceptualisation does not mean deprioritising climate actions. Instead, I suggested a better understanding and management of the politics (institutional and personal).

The NDC enhancement process for Nigeria's associated gas governance needs to reflect realistic financing for critical sectors like gas-to-industry and gas-to-housing. Furthermore, Nigeria's associated gas governance goals showed opportunities for generating energy and meeting economic growth needs; but doing so in an environmentally friendly way. First, however, the systems need to be better connected. Then, somehow, market situations must be created where investors can see a profitable opportunity to shut down flaring or turn it into electricity generation or clean cooking.

The answer could start with implementing policy solutions that are not partially or wholly dependent on the politics of sponsors or hydrocarbon at both levels of abstraction. An approach could be to expand such an idea to cover other nation-states. For example, Nigeria is in the league of flare-countries trying to seize flared associated gas and use this for climate mitigation. However, an action that affects gas is also about the political economy of Nigeria as a sovereign state. Therefore, perhaps it is time to genuinely combine associated gas flaring and its use, social and political goals in our debates on just transition in the social science of climate change (Fankhauser, 2019).

8.4.2   Recommendations for future research

At least three questions arose from this study which could form the basis of future research.

First, research is needed to understand the impact of subsidies on associated gas governance. We need to know about the impact of government as a high counterparty risk on infrastructure investment. Such research could be a comparative analysis of subsidies and counterparty risk in gas-rich countries.

Second, we have not been able to regulate flaring through environmental and climate lenses properly. To avoid the risk of a right/wrong dichotomy, perhaps it is time to get back to the basics of associated gas flare governance. It could comprise goals, instruments and processes. It could be viable for protecting the environment from the harmful practices of flaring while enabling its use as a (presumable) transition energy. Therefore, a natural progression of this study could be increasing the abstraction levels to include oil and gas companies.

Third, my thesis has set a framework for studying global and national gas governance. A natural progression would be to include other countries with similar challenges like Nigeria, expanding the findings using the approach and conceptual frameworks developed here and advancing knowledge. Such research could then lead to consistently mapping, systemising and articulating global associated gas flare governance. However, I caution my readers on the three limitations of what I did (**section 3.5**).

At an instrumental level and extending my pragmatism, there are opportunities to propose and public academic articles from my thesis.

Unified structure of "Overcoming Barriers Better Global and Nigerian Governance of Associated Gas Flare"

A unified approach could cover the global and Nigerian levels as two levels of abstraction but also using the three conceptual frameworks (goals, instruments and processes) and the origins-barriers-influences-solutions approach. Subsidiary academic papers might be titled as:

"Overcoming Barriers to the Governance of Associated Gas Flaring at the global Level"

The global abstraction level might find a wider audience where I go through the process of explaining how we got to where we are. This is a big problem question because not only do we have these

initiatives, but we also have the UNFCCC and every year emissions go up – it is not working. An Academic paper could cover what the problems are and the barriers to resolving them - potentially a series of Policy Briefs and three parts to the paper as highlighted below:

- "A Deeper Understanding of the Origins-Barriers-Policy Solutions for Coherent Global Associated Gas Flare Governance Goals"
- "A Deeper Understanding of the Origins-Barriers-Policy Solutions for Effective International Associated Gas Flare Governance Instruments"
- "A Deeper Understanding of the Origins-Barriers-Policy Solutions for Efficient Global Associated Gas Flare Governance Processes"

Overcoming Barriers to Better Nigerian Governance of Associated Gas Flare

The Nigerian level may be more complex, but an academic paper could be titled "Overcoming Barriers to the Governance of Gas Flaring at the Nigerian Level". I could also have similar policy briefs like the international level covering:

- "A Deeper Understanding of the Origins-Barriers-Policy Solutions for Coherent Nigerian Associated Gas Flare Governance Goals"
- "A Deeper Understanding of the Origins-Barriers-Policy Solutions for Effective Nigerian Associated Gas Flare Governance Instruments"
- "A Deeper Understanding of the Origins-Barriers-Policy Solutions for Efficient Nigerian Associated Gas Governance Processes"

8.5   Qualitative rigour and autobiographical reflections

8.5.1   Qualitative rigour

According to Sovacool et al. (2018; p. 29), "attacks on qualitative research could be due to a lack of rigour, but disciplined and transparent materials and methods are mitigative actions". Therefore, I qualitative rigour as outlined below (Bowen, 2009; Tracy, 2010; Gillard, 2017).

Doctoral-worthy topic: I unravelled global and Nigerian associated gas flare governance. My research connected the dots between climate action and SDGs (UN, 2011), divestments from fossil fuel consumption (OECD, 2019; GOV.UK, 2020) impact on the role of gas in NDC targets (Elvidge et al.,

2018; CCC, 2018; McGlade et al., 2018; Pauw et al., 2019). In addition, we need more framing multilevel governance (Paavola, 2007; Paavola et al., 2009; Fankhauser, 2019).

Coherent (coherence) study: My thesis answers socially relevant research questions and provided incremental knowledge. I also achieved coherence by using systemisation-barriers-solutions for the results chapters. I bound the three results chapters in my discussion with the literature.

Limitations: I clearly outlined the limitations of my thesis. I carefully reflected on the measures to manage my limitations and justified my decisions.

Ethical approval and processes: Instead of laypersons, I interviewed experts and decision-makers who are influential people due to their power or expertise (Sovacool et al., 2018, p. 20). I secured ethical approval from the University of Leeds Ethics Committee. In one instance, a powerful interviewee waived their anonymity without being prompted. I reasoned that it was best to retain anonymity.

Conceptual frameworks and long timelines: My research developed and applied conceptual frameworks over timelines. For example, the global level analysis extends between 2002 to 2020. For the Nigerian level, my analysis starts from 1960 to 2020.

Resonance: I surfaced insights of elite interviewees to explain the social construction of gas governance as goals, instruments and processes. Therefore, I contributed to debates for advancing gas governance as a social, environmental governance science field.

The credibility of insights: I provided a thick description to systematise associated gas flare governance (**Chapter 4**), specify barriers and origins (Error! Reference source not found.) and provided evaluated solutions (**Chapter 6**). I connected tacit to implicit knowledge and checked my results against explicit knowledge.

Originality: My thesis created methods to unravel and systematise associated gas flare governance. Moreover, the systemisation-barriers-solutions spine of my thesis results and the pragmatism enabled a better agency-structure-discourse. It makes my recommendation suitable for academics and practitioners.

8.5.2   Autobiographical reflections

Conducting this research has been a valuable opportunity. I now understand what it takes to conduct doctoral research and its ups and downs, and the challenges of being a full-time employee and a father of two. I have been tried and tested in many ways and reflect on key learning points. While I have questioned my pragmatic philosophy, I now better appreciate other world views but reconciled with mine. This research has given me ideas to challenge and shape my professional values at work.

I now have a healthy appreciation of how governing extends beyond government. I intend to continue to explore the impact of my systemisation of gas governance. For example, I could extend my concepts to other areas in my current work as the Head of Home Decarbonisation Policy at the Department for Business, Energy and Industrial Strategy. I have emerged from this process more assertive (within reason) with a resilient attitude and the ability to face the future positively. In addition, I hope I have made friends or at least professional connections with my two esteemed supervisors.

8.6   Conclusions and next steps

As gas flaring contributes to climate change, it makes further sense to treat associated gas flare governance like environmental governance. In that case, the analysis and evaluation of specific barriers and root origins could add value to associated gas flare governance knowledge. The knowledge of root origins could enhance our chances of protecting the environment from gas extraction activities. Furthermore, prioritisation and sequencing of the targeted policy solutions mean we could better understand how the barriers behave and solve them for better gas governance.

I have made social science and policy contributions to our knowledge base. Beyond enabling more explicit recognition of the significant barriers and root origins, I also offered expert-led policy solutions of what could be there to govern better. Furthermore, the detailed examination of goals, instruments and processes extends our knowledge. It fills gaps in policy frameworks and knowledge in countries like Nigeria for better associated gas flare governance. In addition, the replicability of my thesis makes theoretical and empirical contributions and explains gas governance.

I highlight the following next steps to my readers, future researchers and myself. First, I intend to develop policy opinion articles from my thesis and use these to engage with actors from my units of study as units of calls to action (see section **2.5**). Second, I plan to use these policy opinion articles to develop and conduct one-to-one meetings and focus groups with each of my 30 elite interviewees (n-

11-global and n-19-Nigeria). I could expand this circle through an introduction to other relevant decision-makers. These individual and focus group meetings could help generate impact and contribute to refining the articulation of the systems of gas governance, their barriers and policy solutions. Perhaps this organic process could qualify as a valuable and innovative contribution to studying gas governance.

References

Adeniji, G. 2012. Gas Sector Reforms in Nigeria. 'Gbite Adeniji Advisory.

Adewuyi, O., Kiptoo, M., Afolayan, A., Amara, T., Alawode, O. and Senjyu, T. 2020. Challenges and prospects of Nigeria's sustainable energy transition with lessons from other countries experiences. *Energy Reports*. **6**, pp.993-1009.

Ajugwo, A. 2013. Negative Effects of Gas Flaring: The Nigerian Experience. *Journal of Environment Pollution and Human Health*, **1** (1), pp 6-8. Available from: http://pubs.sciepub.com/jephh/1/1/2/.

Akinola, A. 2017. Resource Misgovernance and the Contradictions of Gas Flaring in Nigeria: A Theoretical Conversation. *Journal of Asian and African Studies*. **53**(5), pp.749-763.

Al Kasim, F. 2006. *The Relevance of the Norwegian Model to Developing Countries*. World Bank.

Alrazi, B., de Villiers, C. and van Staden, C. 2015. A comprehensive literature review on, and the construction of a framework for, environmental legitimacy, accountability and proactivity. *Journal of Cleaner Production.* 102, pp. 44-57.

André, K., Simonsson, L., Swartling, Å. and Linnér, B. 2012. Method Development for Identifying and Analysing Stakeholders in Climate Change Adaptation Processes. *Journal of Environmental Policy & Planning.* **14**(3), pp.243-261.

Antwi-Agyei, P., Dougill, A., Agyekum, T. and Stringer, L. 2017. *Identifying Opportunities for Coherence between the Intended Nationally Determined Contributions and the Sustainable Development Goals: The Case of ECOWAS Member States.* [Online]. Sustainability Research Institute. [Accessed 10 May 2021]. Available from: http://www.see.leeds.ac.uk/fileadmin/Documents/research/sri/workingpapers/SRIPs-110.pdf.

Arts, B. and Tatenhove, J. 2004. Policy and power: A conceptual framework between the 'old' and 'new' policy idioms. *Policy Sciences*. **37**(3-4), pp.339-356.

Banerjee, S. and Toledano, P. 2016. *A Policy Framework to Approach the Use of Associated Petroleum Gas*. [Online]. Academic Commons. [Accessed 10 May 2021]. Available from: https://academiccommons.columbia.edu/doi/10.7916/D8028RQ8.

Bellemare, M. 2017. *How to Publish in Academic Journals; AAEA Early Career Professionals Workshop.* [Online]. [Accessed 10 May 2021]. Available from: http://marcfbellemare.com/wordpress/wp-content/uploads/2017/06/BellemareAAEAEarlyCareerWorkshop.pdf.

Bemelmans-Videc, M., Rist, R. and Vedung, E. 1998. Policy Instruments: Typologies and Theories In: M. Bemelmans-Videc, R. Rist and E. Vedung, eds. *Carrots, Sticks & Sermons: Policy Instruments &*

Their Evaluation [Online]. New York: Routledge, pp. 1-38. Available from: https://doi.org/10.4324/9781315081748.

Beunen, R. and Patterson, J. 2016. Analysing institutional change in environmental governance: exploring the concept of 'institutional work'. *Journal of Environmental Planning and Management*. **62**(1), pp.12-29.

Biddle, J. and Koontz, T. 2014. Goal specificity: A proxy measure for improvements in environmental outcomes in collaborative governance. *Journal of Environmental Management*. 145, pp.268-276.

Bowen, G. 2009. Document Analysis as a Qualitative Research Method. [Online]. Academia.edu. [Accessed 10 May 2021]. Available from: https://www.academia.edu/8434566/Document_Analysis_as_a_Qualitative_Research_Method.

Bulkeley, H., Andonova, L., Bäckstrand, K., Betsill, M., Compagnon, D., Duffy, R., Kolk, A., Hoffmann, M., Levy, D., Newell, P., Milledge, T., Paterson, M., Pattberg, P. and VanDeveer, S. 2012. Governing Climate Change Transnationally: Assessing the Evidence from a Database of Sixty Initiatives. *Environment and Planning C: Government and Policy*. **30**(4), pp.591-612.

Buzcu-Guven, B. and Harriss, R. 2012. Extent impacts and remedies of global gas flaring and venting. *Carbon Management*. **3**(1), pp. 95-108.

Calel, R. and Mahdavi, P. 2020. Opinion: The unintended consequences of antiflaring policies—and measures for mitigation. *Proceedings of the National Academy of Sciences*. **117**(23), pp. 12503-12507.

Capano, G., Howlett, M. and Ramesh, M. 2015. Bringing Governments Back in: Governance and Governing in Comparative Policy Analysis. *Journal of Comparative Policy Analysis: Research and Practice.* **17**(4), pp.311-321.

CCC 2018. Hydrogen in a low-carbon economy. [Online]. Committee on Climate Change. [Accessed 10 May 2021]. Available from: https://www.theccc.org.uk/publication/hydrogen-in-a-low-carbon-economy/.

CDP 2021. Disclosure, Insight, Action. [Online]. [Accessed 10 May 2021]. Available from: https://www.cdp.net/en/info/about-us/disclosure/disclosure-insight-action.

Chasek, P., Essahli, W., Akhtar-Schuster, M., Stringer, L. and Thomas, R. 2011. Integrated land degradation monitoring and assessment: Horizontal knowledge management at the national and international levels. *Land Degradation & Development*. **22**(2), pp.272-284.

Chicago Manual. 2021. The Chicago Manual of Style [Online]. 17th Edition. The University of Chicago. Available from: https://www.chicagomanualofstyle.org/home.html.

Coffey, B. 2014. Overlapping Forms of Knowledge in Environmental Governance: Comparing Environmental Policy Workers' Perceptions. *Journal of Comparative Policy Analysis: Research and Practice*. **17**(3), pp.215-228.

Colombo, E., Barbieri, J. and Brambilla, M. 2015. Alternatives to gas flaring: a multi-criteria decision approach applied to a case study in Russia. *International Journal of Sustainable Engineering*. **9**(3), pp.154-169.

CPI 2017. *Public Impact Fundamentals*. [Online]. Centre For Public Impact (CPI). [Accessed 10 May 2021]. Available from: https://www.centreforpublicimpact.org/research-and-conversations/public-impact-fundamentals.

Dean, J. and Whyte, W. 1958. "How Do You Know If the Informant is Telling the Truth?" *Human Organization*. **17**(2), pp. 34-38.

Dellmuth, L. and Bloodgood, E. 2019. Advocacy group effects in global governance: populations, strategies, and political opportunity structures. *Interest Groups & Advocacy*. **8**(3), pp.255-269.

Edenhofer, O., Pichs-Madruga, R., Sokona, Y., Farahan, E., Kadner, S., Seyboth, K., Adler, A., Baum, I., Brunner, S., Eickemeier, P., Kriemann, B., Savolainen, J., Schlömer, S., Stechow, C., Zwickel, T. and Minx, J. 2014. *Climate Change 2014*. IPCC.

Elvidge, C., Bazilian, M., Zhizhin, M., Ghosh, T., Baugh, K. and Hsu, F. 2018. The potential role of natural gas flaring in meeting greenhouse gas mitigation targets. *Energy Strategy Reviews*. **20**, pp.156-162.

Falkner, R. 2014. Global environmental politics and energy: Mapping the research agenda. *Energy Research & Social Science*. **1**, pp.188-197.

Fankhauser, S. 2019. *Why we need more social science research on climate change - Grantham Research Institute on climate change and the environment*. [Online]. Grantham Research Institute on climate change and the environment. [Accessed 10 May 2021]. Available from: https://www.lse.ac.uk/granthaminstitute/news/why-we-need-more-social-science-research-on-climate-change/.

Fazey, I., Bunse, L., Msika, J., Pinke, M., Preedy, K., Evely, A., Lambert, E., Hastings, E., Morris, S. and Reed, M. 2014. Evaluating knowledge exchange in interdisciplinary and multi-stakeholder research. *Global Environmental Change*. **25**, pp.204-220.

Feindt, P. and Weiland, S. 2018. Reflexive governance: exploring the concept and assessing its critical potential for sustainable development. Introduction to the special issue. *Journal of Environmental Policy & Planning*. **20**(6), pp.661-674.

Fenhann, J., Konrad, S., Wretlind, P., Høgsbro, S. and Drost, P. 2018. *The Climate Initiatives Platform: Towards Greater Transparency in International Cooperative Climate Initiatives (ICIs)*. [Online]. Denmark: Nordic Council of Ministers. [Accessed 10 May 2021]. Available from: https://unepdtu.org/publications/the-climate-initiatives-platform-towards-greater-transparency-in-international-cooperative-climate-initiatives-icis/.

Fligstein, N. and McAdam, D. 2015. *A theory of fields*. Oxford: Oxford University Press.

Flyvbjerg, B. 2006. Five Misunderstandings About Case-Study Research. *Qualitative Inquiry*. **12**(2), pp.219-245.

Geddes, A., Parker, C. and Scott, S. 2017. When the snowball fails to roll and the use of 'horizontal' networking in qualitative social research. *International Journal of Social Research Methodology*. **21**(3), pp.347-358.

Gerring, J. 2004. What Is a Case Study and What Is It Good for? *American Political Science Review*. **98**(2), pp.341-354.

GGFR 2020. *Global Gas Flaring Tracker Report*. [Online]. World Bank. [Accessed 10 May 2021]. Available from: https://www.worldbank.org/en/topic/extractiveindustries/publication/global-gas-flaring-tracker-report.

GGFR 2009. *Guidance on upstream flaring and venting: policy and regulation*. [Online]. World Bank. [Accessed 10 May 2021]. Available from: https://documents.worldbank.org/en/publication/documents-reports/documentdetail/200701468344636937/guidance-on-upstream-flaring-and-venting-policy-and-regulation.

Gillard, R., Gouldson, A., Paavola, J. and Van Alstine, J. 2016. Transformational responses to climate change: beyond a systems perspective of social change in mitigation and adaptation. *Wiley Interdisciplinary Reviews: Climate Change*. **7**(2), pp.251-265.

Giwa-Osagie, O. and Ehigiato, E. 2015. Financing options in the oil and gas sector in Nigeria. *Journal of Energy & Natural Resources Law*. **33**(3), pp.218-240.

GOV.UK. 2020. *PM announces the UK will end support for fossil fuel sector overseas*. [Accessed 10 May 2021]. Available from: https://www.gov.uk/government/news/pm-announces-the-uk-will-end-support-for-fossil-fuel-sector-overseas.

Grimble, R. and Wellard, K. 1997. Stakeholder methodologies in natural resource management: a review of principles, contexts, experiences and opportunities. *Agricultural Systems*. **55**(2), pp.173-193.

Global Reporting Initiative (GRI). 2021. *Standards*. [Online]. [Accessed 10 May 2021]. Available from: https://www.globalreporting.org/standards.

Hale, T. and Roger, C. 2013. Orchestration and transnational climate governance. *The Review of International Organizations*. 9(1), pp.59-82.

Hale, T. 2020. Transnational Actors and Transnational Governance in Global Environmental Politics. *Annual Review of Political Science*. **23**(1), pp. 203-220.

Hancké, B. 2013. *Intelligent research design*. Oxford: Oxford University Press.

Head, B. and Alford, J. 2013. Wicked Problems. *Administration & Society*. **47**(6), pp.711-739.

Holden, S. 2013. Avoiding the resource curse, the case of Norway. *Energy Policy*. **63**, pp.870-876.

IEA. 2020. *Access to electricity – SDG7: Data and Projections – Analysis - IEA*. [Online]. [Accessed 10 May 2021]. Available from: https://www.iea.org/reports/sdg7-data-and-projections/access-to-electricity.

IEA. 2020. *Share of total primary energy demand by fuel, 2010-2019 – Charts – Data & Statistics - IEA*. [Online]. [Accessed 10 May 2021]. Available from: https://www.iea.org/data-and-statistics/charts/share-of-total-primary-energy-demand-by-fuel-2010-2019.

ISO-Environment. 2019. *Climate change mitigation*. [Online]. [Accessed 10 May 2021]. Available from: https://www.iso.org/publication/PUB100271.html.

Klahr, D. 2019. Learning Sciences Research and Pasteur's Quadrant. *Journal of the Learning Sciences*. **28**(2), pp. 153-159.

Kuckartz, U. 2019. Qualitative Text Analysis: A Systematic Approach in: Kaiser G., Presmeg N. (eds). *Compendium for Early Career Researchers in Mathematics Education*. ICME-13 Monographs, pp.181-197.

Leal, F., Rego, E. and de Oliveira Ribeiro, C. 2019. Natural gas regulation and policy in Brazil: Prospects for the market expansion and energy integration in Mercosul. *Energy Policy*. **128**, pp.817-829.

Lee, S., Dessai, S. and Paavola, J. (**In review**) Deeper understanding of barriers to national adaptation policy: Case of the South Korean national adaptation policy. *Climate Policy*.

Lie, R. and Witteveen, L. 2015. Visual informed consent: informed consent without forms. *International Journal of Social Research Methodology*. **20**(1), pp. 63-75.

Lipscomb, M. 2011. *Critical realism and realist pragmatism in mixed method research: the problematics of event identity and abductive inference*. New Orleans: American Educational Research Association.

Lund, P. 2017. Implications of Finland's plan to ban coal and cutting oil use. *Energy Policy*. **108**, pp. 78-80.

Mathias, M. and Szklo, A. 2007. Lessons learned from Brazilian natural gas industry reform. *Energy Policy*. **35**(12), pp.6478-6490.

Maxwell, J. 2013. *Qualitative Research Design: An Interactive Approach.* 3rd edition. London: Sage Publications.

McGlade, C., Pye, S., Ekins, P., Bradshaw, M. and Watson, J. 2018. The future role of natural gas in the UK: A bridge to nowhere? *Energy Policy*. **113**, pp.454-465.

Mesimeris, T. and Partasides, G. 2020. *Cyprus' Integrated National Energy and Climate Plan for the period 2021-2030*. [Online]. Ministry of Energy, Commerce and Industry. [Accessed 10 May 2021]. Available from: https://meci.gov.cy/en/useful-information/strategic-planning/cyprus-integrated-national-energy-and-climate-plan-for-the-period-2021-2030.

Meadows D., 1999, Leverage points: places to intervene in a system, s.I: Sustainability Institute.

Mitchell, J. and Marcel, V. 2015. *Oil and Gas Mismatches: Finance, Investment and Climate Policy*. London: Chatham House.

Mitchell, R., Agle, B. and Wood, D. 1997. Toward a Theory of Stakeholder Identification and Salience: Defining the Principle of Who and What Really Counts. *Academy of Management Review*. **22**(4), pp.853-886.

Montiel, H. 2007. Critical Realism and the Strategic-Relational Approach. *Journal of Critical Realism*. **6**(1), pp. 84-110.

Morrison, T., Adger, W., Brown, K., Lemos, M., Huitema, D., Phelps, J., Evans, L., Cohen, P., Song, A., Turner, R., Quinn, T. and Hughes, T. 2019. The black box of power in polycentric environmental governance. *Global Environmental Change*. **57**, p.101934.

Najam, A., Papa, M. and Taiyab, N. 2006. *Global Environmental Governance: A Reform Agenda*. Winnipeg, Manitoba: International Institute for Sustainable Development.

NDC Partnership. 2021. *Nigeria | NDC Partnership*. [Online]. [Accessed 10 May 2021]. Available from: https://ndcpartnership.org/countries-map/country?iso=NGA.

Nwanya, S. 2011. Climate change and energy implications of gas flaring for Nigeria. *International Journal of Low-Carbon Technologies*. **6**(3), pp.193-199.

Nwapi, C. 2019. The achievement of regulatory excellence in the oil and gas industry in Nigeria: the 2017 National Oil and Gas Policy. *Journal of Energy & Natural Resources Law*. **38**(1), pp. 91-117.

Oberthür, S. 2009. Interplay management: enhancing environmental policy integration among international institutions. *International Environmental Agreements: Politics, Law and Economics*. **9**(4), pp.371-391.

Odumugbo, C. 2010. Natural gas utilisation in Nigeria: Challenges and opportunities. *Journal of Natural Gas Science and Engineering*. **2**(6), pp.310-316.

OECD. 2019. *Donors must do more to align development finance with climate goals - OECD*. [Online]. [Accessed 10 May 2021]. Available from: https://www.oecd.org/development/donors-must-do-more-to-align-development-finance-with-climate-goals.htm.

Oladipo, K., Felix, A., Bango, O., Chukwuemeka, O. and Olawale, F. 2018. Power Sector Reform in Nigeria: Challenges and Solutions. *IOP Conference Series: Materials Science and Engineering*. **413**, pp. 1-13.

Omri, A. and Mabrouk, N. 2020. Good governance for sustainable development goals: Getting ahead of the pack or falling behind? *Environmental Impact Assessment Review*. **83**.

Orji, U. 2014. Moving from gas flaring to gas conservation and utilisation in Nigeria: a review of the legal and policy regime. *OPEC Energy Review*. **38**(2), pp. 149-183.

Paavola, J., Gouldson, A. and Kluvánková-Oravská, T. 2009. Interplay of actors, scales, frameworks and regimes in the governance of biodiversity. *Environmental Policy and Governance*. **19**(3), pp. 148-158.

Paavola, J. 2011. Climate change: the ultimate tragedy of the commons? In: D. Cole and E. Ostrom, eds. *Property in Land and Other Resources.* [Online]. Institute for Land Policy, pp. 417-433. [Accessed 10 May 2021]. Available from: https://www.lincolninst.edu/pubs/dl/1974_1296_Property_In_Land_Web_Chapter.pdf.

Paavola, J. 2007. Institutions and environmental governance: A reconceptualization. *Ecological Economics*. **63**(1), pp. 93-103.

Pauw, W., Castro, P., Pickering, J. and Bhasin, S. 2019. Conditional nationally determined contributions in the Paris Agreement: foothold for equity or Achilles' heel? *Climate Policy.* **20**(4), pp.468-484.

Pérouse de Montclos, M. 2014. The politics and crisis of the Petroleum Industry Bill in Nigeria. *The Journal of Modern African Studies*. **52**(3), pp. 403-424.

Perrez, F. 2006. A World Environment Organization: Solution or Threat for Effective International Environmental Governance by Frank Biermann and Steffen Bauer. *Review of European Community and International Environmental Law*. **15**(2), pp. 234-236.

Ramírez-Cendrero, J. and Wirth, E. 2016. Is the Norwegian model exportable to combat Dutch disease? *Resources Policy*. **48**, pp. 85-96.

Rassel, G., Leland, S., Mohr, Z. and O'Sullivan, E. 2021. *Research Methods for Public Administrators*. Milton: Taylor & Francis Group.

Ritchie, J. and Dowlatabadi, H. 2017. Why do climate change scenarios return to coal? *Energy*. **140**, pp.1276-1291.

Rogelj, J., Shindell, D. and Jiang, K. 2018. Mitigation Pathways Compatible with 1.5°C in the Context of Sustainable Development In: Masson-Delmotte, V., Zhai, P., Pörtner, H., Roberts, D., Skea, J., Shukla, P., Pirani, A., Moufouma-Okia, W., Péan, C., Pidcock, R., Connors, S., Matthews, J., Chen, Y., Zhou, X., Gomis, M., Lonnoy, E., Maycock, T., Tignor, M. and Waterfield. T. eds. *Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty* [Online]. IPCC, pp. 93-174. [Accessed 10 May 2021]. Available from: https://www.ipcc.ch/sr15/.

Rosenbloom, D. 2018. Framing low-carbon pathways: A discursive analysis of contending storylines surrounding the phase-out of coal-fired power in Ontario. *Environmental Innovation and Societal Transitions*. **27**, pp. 129-145.

Ross, G. 2017. *Governing turbulent transitions: the politics of climate change and low carbon transitions during austerity in the UK, 2006-2016*. PhD thesis, University of Leeds.

Roth, W. and Unger, H. 2018. Current Perspectives on Research Ethics in Qualitative Research. *Forum: Qualitative Social Research*. **19**(3).

Roth, W. 2018. A Transactional Approach to Research Ethics. *Forum: Qualitative Social Research*. **19**(3).

Rutherford, J. S. et al., 2021. Closing the methane gap in US oil and natural gas production emissions inventories. Nature Communications, 12(4751).

Shaad, B. and Wilson, E. 2009. *Access to Sustainable Energy: What role for international oil and gas companies? Focus on Nigeria*. IIED Publications Library. [Online]. [Accessed 10 May 2021]. Available from: https://pubs.iied.org/16022IIED.

Shaw, K. 2011. Climate deadlocks: the environmental politics of energy systems. *Environmental Politics*. **20**(5), pp.743-763.

Shields, P. and Tajalli, H. 2006. Intermediate Theory: The Missing Link in Successful Student Scholarship. *Journal of Public Affairs Education*. 12(3), pp. 313-334.

Shields, P. 2008. Rediscovering the Taproot: Is Classical Pragmatism the Route to Renew Public Administration? *Public Administration Review*. **68**(2), pp.205-221.

Sovacool, B., Axsen, J. and Sorrell, S. 2018. Promoting novelty, rigor, and style in energy social science: Towards codes of practice for appropriate methods and research design. *Energy Research & Social Science*. **45**, pp. 12-42.

Spencer, M. 1982. The Ontologies of Social Science. *Philosophy of the Social Sciences*. **12**(2), pp.121-141.

Stern, J., 2019. Challenges to the future of LNG: decarbonisation, affordability and profitability, Oxford: Oxford Institute for Energy Studies.

Stern, N. 2006. *The Economics of Climate Change: The Stern Review - Grantham Research Institute on climate change and the environment*. Grantham Research Institute on climate change and the environment. [Online]. [Accessed 10 May 2021]. Available from: https://www.lse.ac.uk/GranthamInstitute/publication/the-economics-of-climate-change-the-stern-review/.

Stern, P., Sovacool, B. and Dietz, T. 2016. Towards a science of climate and energy choices. *Nature Climate Change*. **6**(6), pp.547-555.

Suter, G. and Cormier, S. 2013. Pragmatism: A practical philosophy for environmental scientists. *Integrated Environmental Assessment and Management*. **9**(2), pp.181-184.

TCFD. 2021. *Publications | Task Force on Climate-Related Financial Disclosures. Task Force on Climate-Related Financial Disclosures*. [Online]. [Accessed 10 May 2021]. Available from: https://www.fsb-tcfd.org/publications/.

Thurber, M., Hults, D. and Heller, P. 2011. Exporting the "Norwegian Model": The effect of administrative design on oil sector performance. *Energy Policy*. **39**(9), pp.5366-5378.

Tracy, S. 2010. Qualitative Quality: Eight "Big-Tent" Criteria for Excellent Qualitative Research. *Qualitative Inquiry*. **16**(10), pp. 837-851.

Transcript of President Muhammadu Buhari's speech at COP26 World Leaders Summit – Tuesday 2nd November 2021.

UN. 2011. Address to the 66th General Assembly: "We the Peoples." UN. [Online]. [Accessed 10 May 2021]. Available from: https://www.un.org/sg/en/content/sg/speeches/2011-09-21/address-66th-general-assembly-we-peoples.

UNEP. 2019. *Climate Initiatives Platform*. [Online]. [Accessed 10 May 2021]. Available from: http://climateinitiativesplatform.org/index.php/Welcome.

UNFCCC. 2013. *CDM: Recovery and utilization of gas from oil fields that would otherwise be flared or vented --- Version 7.0.* [Online]. [Accessed 10 May 2021]. Available from: https://cdm.unfccc.int/methodologies/DB/ET4NXMVXFQ5C2EJ5L1OF8YZIEVLVDA.

UNFCCC. 2015. *Nigeria's First NDC*. [Online]. [Accessed 10 May 2021]. Available from: https://www4.unfccc.int/sites/ndcstaging/.

UN. 2017. *World Population Prospects: The 2017 Revision: Data Booklet | Population Division*. [Online]. [Accessed 2021]. Available from: https://www.un.org/development/desa/pd/content/world-population-prospects-2017-revision-data-booklet.

Urquhart, C., Lehmann, H. and Myers, M. 2009. Putting the 'theory' back into grounded theory: guidelines for grounded theory studies in information systems. *Information Systems Journal*. **20**(4), pp.357-381.

Valentine, S., Sovacool, B. and Brown, M. 2017. Frame envy in energy policy ideology: A social constructivist framework for wicked energy problems. **Energy Policy**. **109**, pp.623-630.

Van Alstine, J., Manyindo, J., Smith, L., Dixon, J. and AmanigaRuhanga, I. 2014. Resource governance dynamics: The challenge of 'new oil' in Uganda. *Resources Policy*. **40**, pp. 48-58.

Van de Graaf, T. and Colgan, J. 2016. Global energy governance: a review and research agenda. *Palgrave Communications*. **2**(1).

Verdeil, É., Arik, E., Bolzon, H. and Markoum, J. 2015. Governing the transition to natural gas in Mediteranean Metropolis: The case of Cairo, Istanbul and Sfax (Tunisia). *Energy Policy*. **78**, pp.235-245.

Wengraf, L. 2017. *The Pillage Continues: Debunking the Resource Curse.* ROAPE. [Online]. [Accessed 10 May 2021]. Available from: https://roape.net/2017/01/24/pillage-continues-debunking-resource-curse/.

West, R., Michie, S., Chadwick, P., Atkins, L. and Lorecatto, F. 2020. *Behaviour change: guides for national and local government and partners*. GOV.UK. [Online]. [Accessed 10 May 2021]. Available from: https://www.gov.uk/government/publications/behaviour-change-guide-for-local-government-and-partners.

Wood, D., Nwaoha, C. and Towler, B. 2012. Gas-to-liquids (GTL): A review of an industry offering several routes for monetizing natural gas. *Journal of Natural Gas Science and Engineering*. **9**, pp.196-208.

Woods, M. 1998. Rethinking Elites: Networks, Space, and Local Politics. *Environment and Planning A: Economy and Space*. **30**(12), pp.2101-2119.

World Bank. 2017. *Development Projects: Nigeria Electricity and Gas Improvement Project (NEGIP) - P106172.* World Bank. [Online]. [Accessed 10 May 2021]. Available from: https://projects.worldbank.org/en/projects-operations/project-detail/P106172.

World Bank. 2004. *Regulation of associated gas flaring and venting: a global overview and lessons from international experience*. World Bank. [Online]. [Accessed 10 May 2021]. Available from: https://documents.worldbank.org/en/publication/documents-reports/documentdetail/590561468765565919/regulation-of-associated-gas-flaring-and-venting-a-global-overview-and-lessons-from-international-experience.

World Bank. 2005. *Regulatory effectiveness: The impact of regulation and regulatory governance arrangements on electricity industry outcomes* [Online]. Washington, DC: World Bank. [Accessed 10 May 2021]. Available from: https://openknowledge.worldbank.org/bitstream/handle/10986/8875/wps3536.pdf?sequence=1.

World Bank. 2020. *State and Trends of Carbon Pricing 2020*. [Online]. [Accessed 10 May 2021]. Available from: https://openknowledge.worldbank.org/handle/10986/33809.

World Bank. 2020. *Worldwide Governance Indicators-Home*. [Online]. [Accessed 10 May 2021]. Available from: https://info.worldbank.org/governance/wgi/.

Yin, R. 2012. *Applications of case study research*. Los Angeles: Sage.

Yu, M., Wang, K. & Vredenburg, H., 2021`. Insights into low-carbon hydrogen production methods: Green, blue and aqua hydrogen. International Journal of Hydrogen production methods: Green, blue and aqua hydrogen, 46(41), pp. 21261-21273.

Appendix A Ethical approval

Research and Innovation Service

Level 11, Worsley Building

University of Leeds

Leeds, LS2 9NL

Tel: 0113 343 4873

Email: ResearchEthics@leeds.ac.uk

UNIVERSITY OF LEEDS

Oyiyole Augustine Entonu

School of Earth and Environment

University of Leeds

Leeds, LS2 9JT

ESSL, Environment and LUBS (AREA) Faculty Research Ethics Committee

University of Leeds

25 January 2017

Dear Oyiyole

Title of study:	**Financing alternative use of natural gas in Nigeria through climate finance and carbon markets. [The title has changed to Unravelling international and Nigerian gas governance]**
Ethics reference:	**AREA 16-036**

I am pleased to inform you that the above research application has been reviewed by the ESSL, Environment and LUBS (AREA) Faculty Research Ethics Committee. Following receipt of your response to the Committee's initial comments, I can confirm a favourable ethical opinion as of the date of this letter. The following documentation was considered:

Document	Version	Date
AREA 16-036 Ethical_Review_Form_200807299-Augustine Entonu- v 1.01.pdf	1	25/10/16

AREA 16-036 Augustine Entonu-Information sheet- V 1.0 (2).pdf	1	25/10/16
AREA 16-036 Augustine Entonu - Focus Consent letter_email V 1.0.pdf	1	25/10/16
AREA 16-036 Augustine Entonu - Interview Consent letter_email V 1.0.pdf	1	25/10/16
AREA 16-036 200807299-Augustine Entonu-Fieldwork_Assessment_Form_high_risk_final_protected_nov_15_V 1.0 (2).pdf	1	25/10/16
AREA 16-036 Augustine Entonu - Interview Consent letter_and form V 1.01.docx	2	13/12/16
AREA 16-036 Ethical_Review_Form_200807299-Augustine Entonu-v 1.02.docx	2	13/12/16
AREA 16-036 Augustine Entonu - Focus Consent letter_and form V 1.01.docx	2	13/12/16

Please notify the committee if you intend to make any amendments to the information in your ethics application as submitted at the date of this approval, as all changes must receive ethical approval prior to implementation. The amendment form is available at http://ris.leeds.ac.uk/EthicsAmendment.

Please note: You are expected to keep a record of all your approved documentation, as well as documents such as sample consent forms, and other documents relating to the study. This should be kept in your study file, which should be readily available for audit purposes. You will be given a two-week notice period if your project is to be audited. There is a checklist listing examples of documents to be kept which is available at http://ris.leeds.ac.uk/EthicsAudits.

We welcome feedback on your experience of the ethical review process and suggestions for improvement.
Please email any comments to ResearchEthics@leeds.ac.uk.

Yours sincerely

Victoria Butterworth

Research Ethics Administrator, Research & Innovation Service

On behalf of Dr Kahryn Hughes, Chair, AREA Faculty Research Ethics Committee

CC: Student's supervisor

Appendix B Interview protocols and codes

Appendix B.1 Global interviewees: codes and years of experience

SN	Interviewee code	Years of experience
1.	GINT1	46
2.	GINT2	47
3.	GINT3	12
4.	GINT4	11
5.	GINT5	15
6.	GINT6	16
7.	GINT7	30
8.	GINT8	30
9	GINT9	35

Appendix B.2 Nigerian interviewees: codes and years of experience

SN	Code	Years of experience
1.	NGN1	35
2.	NGN2	37
3.	NGN3	30
4.	NGN4	20
5.	NGN5	19
6.	NGN6	15
7.	NGN7	25
8.	NGN8	27
9.	NGN9	23
10.	NGN10	35
11.	NGN11	25
12.	NGN12	27
13.	NGN13	15
14.	NGN14	20
15.	NGN14	20
16.	NGN17	21

17.	NGN18	25
18.	NGN19	21
19.	NGN20	20

Appendix B.3 Global interview protocol

Question 1: Awareness testing of the initiatives	☐
Question 2: Describing the initiatives and assessment of goals, probing for progress against goals and generating further insights on key challenges.	☐
Question 3: Critical analysis of gas governance instruments, covering aspects of normative, market and knowledge-based instruments, significance and application of KM and best practices.	☐
Question 4: Approaches to implementation, covering aspects of activities and collaboration	☐
Question 5: Solutions to challenges at the global level	
Question 6: Countries	☐
Question 1: Awareness testing of the initiatives	
Thank you for accepting my interview request. Before we start, there are two things I would like to confirm with you. First, the purpose of this interview is to gather your insights on the governance of the reduction of flaring and utilisation of gas. The length of the interview is up to an hour. Second, do you know of: 1.A The Global Gas Flaring Reduction Partnership? Yes☐ No ☐? 1.B The UNFCCC CDM method number AM0009? Yes☐ No ☐? 1.C The Global Methane Initiative? Yes☐ No ☐? 1.E Oil and Gas Climate initiative? Yes☐ No ☐? 1.E Zero Routine Flaring by 2030? Yes☐ No ☐?	3 min

1.F. Are there any other relevant initiative for gas governance? 1.G What are the other relevant initiatives for gas governance?	
Question 2: Describing the initiatives and assessment of goals, probing for progress against goals and generating further insights on key challenges.	
Question 2.A. What are your priority goals, and what time frames apply to the goals?	5 mins
Question 2.B. In your opinion, do the **goals** of the five gas governance initiatives overlap? If so, which ones and how? What are the justifications for having multiple initiatives with similar goals?	5 mins
Question 3: Critical analysis of gas governance instruments, covering aspects of normative, market and knowledge-based instruments, significance and application of KM and best practices.	
Question 3.A. Why is there a preference for knowledge and market-led governance instead of normative governance? Could norms, standards and hard targets work and help achieve more (faster) in gas governance?	5 mins
Question 3.B. Do you share knowledge with other initiatives (especially the other four mentioned)? *If yes, how? If not, why not?*	5 mins
Question 4: Approaches to implementation, covering aspects of activities and collaboration	
Question 4.A. In your opinion, do you find there is any duplication in the **activities** of initiatives? If so, in what ways?	5 mins
Question 4.B. Does a lack of working together create challenges in achieving the kinds of outcomes and goals your initiative looks to achieve? If so, why, and how? *If not, what are the key challenges?*	7 mins
Question 5. In your opinion, what needs to be improved at the global level to advance progress towards the goals of the initiatives? How would you implement it?	10 mins
Question 6: Countries; In your opinion, how is Nigeria performing in the reduction of flaring and increased usage of gas compared to other places in the developing world? Also, what could be done to overcome barriers - solutions that could help them to meet their targets and goals?	5 mins

My descriptive analysis had shown potential barriers in goals, instruments and process for better global gas governance. Therefore, I used my interviews and further document analysis to determine specific barriers and find targeted solutions, as highlighted below.

Goals

First, a potential barrier arising from the analysis was overlapping goals. However, these were not substantive or explanatory. Therefore, I looked for further evidence of barriers, their significance origins and root origins through triangulation, a process I also applied across instruments and processes. Consequently, I asked my interviewees, "do the goals of the five global gas governance initiatives overlap? If so, which ones and in which way?" I generated evidence of how and why the nature of their goals manifested as critical barriers for effective global gas governance. As outlined in the table below, my interview questions assessed the interviewees' leading global gas governance ICI awareness levels. Furthermore, I gathered and analysed the evidence and found challenges due to structure and goals. Notably, when assessing if a gas governance ICI's goal was quantified, specified or measurable with milestones, I did so with the understanding that not all goals can have these attributes.

It was best to seek solutions through stakeholder recommendations. So, I asked, "in your opinion, what needs to be improved at the global level to advance your goals? How would you implement it?" The solution question was also applicable across instruments and processes.

Instruments

Second, my descriptive analysis of global and climate action governance instruments also showed a preference for knowledge and market-based gas governance over a normative instrument. However, these were not explanatory or substantiated. So, I asked my interviewees, "why is there a preference for knowledge and market-led governance instead of normative governance? Could the use of norms, standards and hard targets work and help achieve more (faster) in gas governance?" I was able to secure corroboratory and explanatory evidence confirmation of the preference in addition to opposing evidence. This result highlighted challenges in using markets and knowledge-based governance to the detriment of norms and standards. However, the combination of financial resources (markets) and knowledge assets of the initiatives could create norms and rules that the national level could adopt. If my case study initiatives did not share knowledge, there could be a lack of effective global gas governance. I found a gap in sharing knowledge, a critical KM process, from

documentary evidence and needed to gain added insights from interviews. I asked interviewees, "do you share knowledge with other initiatives (especially the other four I have mentioned)? If yes, how? If not, why not?"

Processes

Third, there was a need to explain further the lack of collaboration, which I did through my interview questions on the challenges faced by global gas governance initiatives. I triangulated and sought explanatory evidence through my interview. I asked my interviewees, "in your opinion, do you find there is any duplication in the activities of initiatives? If so, in what ways? If not, what are the key challenges?" Beyond the duplication of functions and activities lies the more significant lack of collaboration which has been a simmering issue throughout my research. I analysed the interviews to generate definitive evidence of whether this was a crucial challenge in global gas governance initiatives.

Appendix B.4   Nigerian interview protocol

Goals of gas governance
Question 1: Recent changes have led to introducing the Norwegian model for hydrocarbon governance to Nigeria, which involves the separation of roles and responsibilities for policy, regulation, and commercial activities.
A. What are the key barriers and difficulties associated with the implementation of the Norwegian model in Nigeria?
B. Given the key barriers, including a potential lack of capability, why would Nigeria choose to implement the full-scale Norwegian model?
C. What needs to change to implement the policy successfully? What actions can address the persistent challenges of implementing the Norwegian model?
Instruments of gas governance
Question 2: Nigeria's flaring level is currently 5% of the global problem. The reduction in flaring has plateaued at 5% since 2014, while Nigerian lack electricity. Comparably, Norway's penalty for flaring is $120 compared to the now enhanced Penalty in Nigeria of $2.
A. What else would it take to substantially reduce Nigeria's level of flaring from the current 5% of global flaring? What would be the best solutions for doing so? While Nigeria and Norway have the same oil operators, why can we not have higher penalties - aside from persistent pre-existing challenges?
B. What are the best solutions (instruments of governance) to be used in reducing Nigeria's flaring levels apart from penalties, and how could they be designed and implemented?

Question 3: What do you think will characterise the gas (and oil) sector in Nigeria in 10 years? How different will the governance process and the sector itself look like?
A. Pessimistic scenario
B. Optimistic scenario
Gas governance processes
Question 4: Nigeria's Nationally Determined Contribution (NDC) targets are ambitious. In your opinion, what are the main challenges for delivering the conditional and unconditional mitigation targets through the reduction of flaring and changing how Nigeria uses its associated gas resources?
Question 5: Again, looking at the climate change angle, there are at least two players – aside from the oil and gas companies and project implementers; these are Nigerian and global:
A. In your opinion, what added measures should Nigeria take to realise its NDC ambition as it has to do with mitigation of GHG from associated gas and at pace?
B. In your opinion, what added measures should the international community take to help Nigeria realise its Nationally Determined Contribution for Climate Change ambition?
Question 6: There are at least two co-regulators in the gas and oil sector. These are the DPR (MPR) and the DCC(MoE).
A. In your opinion, how effective are DPR? How well are they integrated and work with the DCC?
B. In your opinion, how effective are the DCC? How well are they integrated and work with the DPR? Direct question to DCC: When and how have you reached out to DPR to raise awareness of climate change actions you take? How do you refresh your relationship with them, given the critical role they play as regulators for gas flares and flaring 40% of the NDC?
C. What is the difference between the roles of the Nigerian Petroleum Commission and the DPR in gas governance and the role of the Department for Gas Resources, and the importance of separating the gas regulator from the Petroleum Regulator?
Nigerian Gas Flare Commercialisation Programme (NGFCP)
Question 7: What are the programme goals, and how is it a risk to itself?
A. What is Nigeria looking to achieve from the commercialisation programme? Could you provide more specific information could you provide?
B. What should/are/could the global actors be looking for from the programme given the hesitance to back hydrocarbon investment by the G7 countries and western donors who fund international development organisations?
Question 8: What do you see as the critical challenges for the programme?
Question.9: What are the solutions to the key challenges for the programme?

Appendix C Abstracts for Chapters 4-6

Appendix C.1 Chapter four abstract

This chapter systematised the global and Nigerian gas governance. To effectively target policy solutions at barriers for better governance that deliver sustainability benefits, we need to know more. We need to know about the barriers, their significance, origins and root influences, and how they influence the current system, assuming one exists.

I used an extensive document analysis (76) and concept-driven thematic analysis to capture and describe the goals, instruments and processes of global and Nigerian gas governance to articulate the system.

I articulated the global and Nigerian gas governance system as a loosely connected entity made up of two abstraction levels and three parts: goals, instruments and processes. In turn, each of the three parts has three aspects that could contribute to the system's viability as a single entity. However, 11 barriers mean this is not the case.

Goals need to be coherent. Coherence means intelligent coordination, steady communication, and a sense of mutual direction among constituent parts of the system. Emerging barriers include a lack of proportionality, focus on flaring, interlinked goals and high NDC conditionality.

Instruments need to be effective, and this means effective knowledge, market and normative instruments. Emerging barriers include lack of published information, policymaking fundamentals, and infrastructures and commercial frameworks. In addition, the standalone nature of market instruments means there are emerging barriers for effective instruments threatening the viability of the systems.

Processes need to be efficient. Efficient processes mean knowing whom to collaborate with, enabling environment and willingness to collaborate, and capability to collaborate. However, a weak deployment of knowledge management, duplication of activities and a lack of systems thinking coupled with a fragmented gas governance system mean fragmented processes.

These emerging barriers are analysed in chapter five to determine their specific manifestation origins and root causes and influences for targeted policy solutions.

Appendix C.2 Chapter five abstract

This chapter traces the barriers and origins and figures out the significance, root origins and influences for targeted policy solutions. It is an extension of the systemisation and articulation of the global and Nigerian gas governance. Specifically, it confirms or refutes the emerging barriers from chapter four. I applied a thematic and narrative analysis encompassing five global initiatives and nine Nigerian governmental organisations to generate three findings.

First, a lack of intelligent coordination, steady communication and mutual sense of direction lead to incoherent goals at both levels. At the global level, the politics of sponsors lead to a lack of horizon scanning, awareness and engagement, which is worsened by a lack of specialisation and overlapping goals. At the Nigerian level, hydrocarbon politics leads to dysfunctional incentivisation. This dysfunctionality makes it difficult for gas to have a commercial and climate action identity, worsened by a mismatch in political and investment cycles.

Second, ineffective knowledge, market and normative instruments means a lack of effective instruments. At the global level, a sense of proprietary knowledge, transition from the Kyoto Protocol to the Paris Agreement and lack of political authority leads to a weak knowledge management process. It contributes to a lack of financing and incomplete standards and norms. At the Nigerian level, a 60-year institution of governance evolution, changing nature of donor funding, subsidies and a lack of gas-specific legislation leads to high counterparty risk, lack of accurate data, climate financing, commercial frameworks and a disabling lack of legislation.

Third, not knowing whom to collaborate with, a lack of enabling environment (and willingness) and capability means inefficient processes. At the global level, a lack of systems thinking leads to a lack of horizontal collaboration, duplication of activities contributes to few flare-out projects and degrees of frustration with lack of progress. At the Nigerian level, a lack of systems thinking also leads to a breakdown in the governance process. Besides a lack of regulatory clarity, cross-cutting coordination and capability are process barriers worsened by uncoordinated global capability-building efforts.

While the barriers are easier to tackle because gas governance is at a formative stage, this requires targeted policy solutions, which the next chapter provides.

Appendix C.3   Chapter six abstract

This chapter supplies targeted policy solutions to shift the systems towards viability as an extension to tackling the significant barriers and root origins from Error! Reference source not found.. I used elite interviews and concept-driven and thematic-narrative analysis. My fieldwork encompassed five global initiatives and nine Nigerian governmental organisations and stakeholder groups to generate three major findings.

The first policy solutions could start with orchestration and advocacy. Then, they could progress towards objective-based incentivisation and increased access to gas-for-cooking, helping to tackle barriers of goal coherence at both abstraction levels. These policy solutions target goal coherence barriers, including a lack of horizon scanning, specialisation, and engagement at the global level. At the Nigerian level, the goal coherence barriers included dysfunctional incentivisation and a mismatch in political and investment cycles.

The second policy solution could start with better knowledge management to develop instruments. They could also include effective use of climate risk, accurate data, tackling high counterparty risk, supported by a collaborative process of developing standards at both abstraction levels. These policy solutions tackle a lack of effective instruments, including proprietary knowledge and the Kyoto Protocol's transition to the Paris Agreement. They also tackle a lack of political authority, leading to inefficient knowledge management processes and ineffective financing instruments. In addition, they tackle incomplete standards and norms at the global level. Moreover, they also reduce the instrument barriers at the national level.

The third policy solution could constantly monitor and evaluate activities, enhancing regulatory clarity through a national strategic implementation group. The solutions could include empowering and building capabilities through better coordinated global efforts. These solutions target inefficient processes, including a lack of systems thinking drives barriers and a lack of horizontal collaboration. They also tackle duplication of activities at the global level.

Overall, prioritising the policy solutions, starting with those not blocked by the politics of sponsors (global level) and a lack of legislation at the Nigerian level, is the most pragmatic way forward. This approach means sequencing the implementation of the policy solutions, starting with those which could be implemented earliest, and which are the most accessible.

Appendix D Other concepts for systemising associated gas flare governance

While this thesis described knowledge, market and normative instruments of gas governance, there are also other pragmatic aspects. I recently found how capability, opportunity and motive can change behaviour – referred to as a COM-B model (West, et al., 2020), further extending my conceptualisation of gas governance. For example, we could consider three types of levers of action at national levels. We need to pull these levers simultaneously if we want to change behaviour on what to do with gas.

- **The first lever is the direction for action:** the knowledge of actors (countries and other stakeholders at country levels). They need to know what is expected from them. This approach could lead to more coherent goals, connected individually at the global and national level and as an entity.

- **The second is the power to act**: even if actors know what is expected of them, they need the instruments and empowerment to act. The power to act is covered in the effectiveness of the instruments and vias into enabling environments.

- **The third is the capability and willingness to act**: even if the actors know what is expected from them, they still need to know how to deliver what we expect. The capability and willingness to act is covered in my analysis of processes of gas governance. In addition, this includes whether there are internal incentives to encourage the actors to do something different.