Understanding the nature, structure and relationships
that make up the gold mining industry in Ghana:
A multi-framing, multi-level exploration

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Abstract

The gold mining industry in Ghana is characterised by complexity in terms of its extended/sequential operations, its system-wide reach, its multiple stakeholders, and the variety of formal and informal organisations that constitute the industry. Perceptions of the industry differ considerably amongst stakeholders, depending on their stakes and interests, knowledge, understanding, involvement and agency within or without the sector. Studies of the industry to date have overlooked these diverse viewpoints and used limited-scope, single-frame analyses. However, they have highlighted wide-ranging industry issues that impact the diversity of stakeholders, which could benefit from a fuller and more comprehensive analysis.

This study addresses this need by adopting a multi-framing systems-based approach. Data was examined and analysed through a variety of systems-based lenses and frames, including a stakeholder analysis (SA) frame, a causal loop modelling (CLM) frame, supply chain analysis (SCA) frame and the Theory of Constraints (TOC) Thinking Processes analytical frames lenses. First the Current Reality Tree (CRT) tool of the Theory of Constraints (TOC) was used to synthesise information from the literature examined, providing an initial provisional CRT model. Interview data was collected by sharing and seeking feedback to the CRT model at multiple levels of the industry, giving voice to stakeholders throughout the sector. Subsequent analysis used all the modelling frameworks mentioned above in a multi-framing analysis.

In particular, the evaporating cloud (EC) tool from TOC was used to structure and develop potential solutions to conflict highlighted by the literature review, the SA, SCA and CLM. Building on this, a final CRT was developed, and a goal tree (GT) used to design the desired future whilst employing the future reality tree (FRT) to test the plausibility of solutions from the EC to deliver the desired future. The prerequisite tree (PRT) was then used to identify obstacles and intermediate objectives that must be overcome for successful transition to the desired future.

Insights from the research shows a desire by multi-national large scale-gold mining companies and government alike to minimise adverse impacts and maximise the sector's outcomes for key stakeholders, including those at the community level. However, the research has documented many instances of actions taken to address issues and improve outcomes that have instead resulted in unresolved dilemmas and paradoxes, failing to achieve desired outcomes.

A number of factors have been identified as being responsible for these situations. Key amongst them is a limited understanding to deliver desired outcome for stakeholders without compromises, a focus on short-term goals, no collective effort, and arms-length/win-lose relationships amongst the Ghanaian stakeholders of the industry.

The study's concluding findings and results allow decision makers to benefit significantly from the study through its recommendations and showcasing of tools that may allow them to make sound decisions and address endogenous and exogenous cause-effect relationships limiting desirable outcomes from actions taken.

Theoretical and knowledge-based contributions are made by conceptualising and offering evidence for three key factors or dimensions that can explain a significant number of issues limiting desirable outcomes for stakeholders of the gold mining industry. These include difficulty to transition from theory (espoused aims) to practice, a relative focus on local optima (silo thinking), poor monitoring (lack of evaluation), and a control culture. Methodological contributions are made by demonstrating the application of a multi-framing approach in a more organic and iterative manner as opposed to its use in a designed sequence, working down through layers of various systemic levels of an industry (in this case, the gold mining industry in Ghana). By so doing, the study builds on and extends the practicality of the multi-framing approach and stimulates further research in the field.

In terms of its contribution to practice, the study provides Government, political and mining sector policy decision makers, and other interested actors, with a platform for understanding the sector in order to support their decision making about the industry to ultimately improve outcomes for key stakeholders. In particular, the study allows mining sector policy decision makers and other stakeholders to recognise complexity, uncertainty and conflicts that are embedded in the mining system and in their everyday decision-making activities about the industry. It also allows these stakeholders to become more aware that such issues can be addressed and improved by identifying and focusing on one or few underlying causes.

This thesis draws on systems-based frameworks drawn both from functional management, for example, the supply chain and value chain frameworks of operations management and the stakeholder framework of strategic management, and from the broad domain of systems thinking (ST) and systems-based methodologies; and then focuses on the intersection of these frameworks in relation to the gold mining sector in Ghana. Due to the wide range of techniques applied, none are over-explored, creating potential for further research. On the other hand, with regard to explanations, depending on background, practitioners, and researchers familiar with some techniques may consider those sections over-explained. The researcher has sought a balance for the purpose of this study. Whilst limiting the scope of this work has been necessary in the context of doctoral study, topics ripe for future research are set out in the conclusion.

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List of acronyms

5FS	5 Focusing Steps
AfCFTA	African Continental Free Trade Area
AMV	African Mining Vision
ARL	Agyapa Royalties Limited
AISC	All-In Sustaining Costs
ASSGM	Artisanal Small-Scale Mining
BOPP	Bogoso Oil Palm Plantation
BoT	Behaviour over time
CAPEX	Capital Expenditure
CBA	Community Benefit Agreement
CHRAJ	Commission on Human Rights and Administrative Justice
CLC	Community Livelihood Compensation
CLD	Causal Loop Diagram/Diagramming
CM	Community Mining
CLM	Causal Loop Modelling
CLR	Categories of Legitimate Reservations
CQS	Change Question Sequence
CSRAM	Corporate Social Responsibility Agreement Model
CSF	Critical Success Factor
CSR	Corporate Social Responsibility
DCE	District Chief Executive
EC	Evaporating Cloud
EPA	Environmental Protection Agency - Ghana
ERSBA	Environmental Rehabilitation and Security Bond Agreement
ETF	Exchange Traded Fund
fCRT	Focused Current Reality Tree
FtF	Fixes that Fail
FDI	Foreign Direct Investment
FRT	Future Reality Tree
GCoM	Ghana Chamber of Mines
GT	Goal Tree
ICfP&E	Imani Centre for Policy and Education
ICMM	International Council on Mining and Metals
IFC	International Finance Corporation
ImE/'s	Intermediate Effect/Effects
INJ	Injection
IO	Intermediate Objective
LGB	Local Ghanaian Businesses
LSGMS	Large Scale Gold Mining Sector
LVB	Land Valuation Board

MA	Management Attention
MCE	Municipal Chief Executive
MMA	Minerals and Mining Act
MMAA	Minerals and Mining Amendment Act
MIIF	Mining Income Investment Fund
MinCom	Minerals Commission - Ghana
MoLNR	Ministry of Lands and Natural Resources
MOU	Memorandum of Understanding
MTA	Make to Availability
MTO	Make to Order
MTS	Make to Stock
NC	Necessary Condition
NE	Negative Effect
NSDP	National Suppliers' Development Program
PNDC	Provisional National Defence Council
OECD	Organisation for Economic Cooperation and Development
POOGI	Process of ongoing improvement
PRT	Prerequisite Tree
SCA	Supply Chain Analysis
SC	Supply Chain
SDG	Sustainable Development Goal
STA	Stakeholder Analysis
StB	Shifting the Burden
TOC	Theory of Constraints
TOCICO	Theory of Constraints International Certification Organisation
TPS	Thinking Processes
TRT	Transition Tree
UDE/'s	Undesirable Effect/Effects
UN	United Nations
VCA	Value Chain Analysis
VC	Value Chain
VMI	Vendor Managed Inventory
WiMiG	Women in Mining Ghana

Chapter 1 : Introduction

The work of managers, of scientists, of engineers, of lawyers...is largely the work of making decisions and solving problems to drive the course of society and its economic and governmental organisations (Simon et al., 1987)

The mining industry in Ghana has seen major development over the three decades spanning the millennium, attracting the attention and investment of large-scale multinational mining companies all over the world, and resulting in substantial increases in levels of production, especially, for mainstream mineral reserves. For instance, from 1983 to 2011, foreign direct investment (FDI) in mining increased from what was a low base of USD 6 million to USD 1 billion; and was accompanied by gold production increasing more than ten-fold from 287,124 to 3.65 million ounces; bauxite extraction almost doubled from 226,461 to 409,929 metric tonnes; whilst manganese production rose seven-fold from 262,900 to 1,757,387 metric tonnes (Minerals Commission of Ghana, 2015).

However, the economic and social benefits for Ghana associated with such mining sector developments – particularly, economic development and poverty reduction – are not being realised relative to expectations, whilst the adverse effects, for example, loss of livelihoods in mining communities, continue to grow (Akabzaa, 2009; Assan & Muhammed, 2018; Hira & Busumtwi-Sam, 2018; Konadu-Agyemang, 2018). This aligns with concerns raised by other governing bodies such as the Commission on Human Rights and Administrative Justice (CHRAJ), quoted in the first quarter 2009 Ghana mining report of Business Monitor International (2009, p. 6) that “Ghana’s mining laws are designed to attract foreign investors and not to protect the rights of local communities”.

Also, the Minerals Commission of Ghana (2015) has highlighted a number of issues facing the mining industry in Ghana, key amongst which are: environmental concerns from mining, unequal distribution of mining benefits to stakeholders, lack of integration of mining with other economic sectors, and the inadequacy of benefits derived from the mining sector that are retained in Ghana.

In addition, information from the office of the Vice President of the Republic of Ghana reveals concern that, whilst about USD 1.2 billion of operational expenses of Multinational Mining Companies (MMCs) are spent locally on an annual basis, local Ghanaian businesses¹ (LGBs) are yet to exploit full benefit from this spill-over (Ghana News Agency, 2017).

These views suggest an awareness that mining can be both economically attractive and environmentally threatening, with adverse implications, for example, on human health and biodiversity loss. Hence, different stakeholders, that is the state, communities and investors, have

¹ LGBs refers to small and medium-scale local businesses owned and operated by Ghanaians, particularly in the mining supply chain

different interests, demands, expectations and wishes, when it comes to mining and its benefits. Such industry complexity can often impact managerial complexity.

Whilst there have been many studies of the gold mining industry in Ghana, those studies that reflect a descriptive contextual analysis have mainly assessed the sector through the single lens of, for example, the Ghanaian Government's Structural Adjustment Program (SAP) at the industry level, and have often recommended the adoption of corporate social responsibility (CSR) measures as providing a solution to issues that surface at the firm level. Davies and Mabin (2001b) recommend use of multiple frames or lenses when faced with complex issues of a managerial concern. Thus, analyses of the industry could usefully employ multiple perspectives in order to understand system-wide effects which are sometimes undesirable and support better decision making and improved outcomes from the sector.

1.1 Purpose and aim of the study

This study seeks to contribute empirical knowledge of the gold mining industry in Ghana using a multi-framing and complementary systems modelling approaches to capture multiple aspects and stakeholders' interests. This will help to provide much fuller understanding of what is holding back the industry, where and how it may be improved. It would also improve our understanding of what needs to change, what to change to, and then how to cause the change. Such knowledge, insight and understanding would contribute to better management and sound decision making about the industry and ultimately, improve outcomes for disparate stakeholders of the sector. The study approaches this topic through the guiding research questions:

- ❖ What is the nature, structure, and relationships that make up the gold mining industry in Ghana?
- ❖ How can decision makers logically analyse (identify and understand), and address significant problems limiting desirable outcomes for the industry?
- ❖ What is the utility of a multi-framing approach in providing a platform for decision making and problem solving about the industry?

Addressing the above research questions and sharing that understanding with its stakeholders to then support better decision making and explore alternatives that could help improve outcomes from the sector, may provide a platform for better management, sound decision making and problem solving about the industry to ultimately improve outcomes for key stakeholders. Thus, the study's findings and results may allow decision makers to benefit significantly from the study through its recommendations and showcasing of tools that may allow them to make sound decisions and address endogenous and exogenous cause-effect relationships limiting desirable outcomes from actions taken. The researcher's interest in this area arises from prior employment in the industry together with knowledge of previous studies and official statements that give a clear signal that the contribution of the gold mining industry in Ghana could be enhanced. This study seeks to determine appropriate frameworks for examining the industry.

1.2 Existing views on how to analyse the gold industry in Ghana

A range of similar concerns about the actual contribution of gold mining to the welfare of Ghana and related perceptions about the developmental potential of the sector, have led interested researchers and other stakeholders to a number of important recommendations (Figure 1.1). For example, Tsuma (2010) suggests a primary need to undertake a thorough analysis of the gold mining industry, while Bloch and Owusu (2012) argue for understanding the valuable economic linkages associated with the mining supply chain that are little understood and hence not fully exploited. Scholars, including Hilson, Hilson, and Adu-Darko (2014); Campbell (2012) also imply that there is a need to identify root causes of significant problems preventing the gold mining industry in Ghana from becoming more effective. From a broader national perspective, the Minerals Commission of Ghana (2015) is of the view that the sector's problems need to be addressed in a manner that enhances its 'competitiveness' to deliver benefits to key stakeholders, particularly the state, communities and investors (multinational large scale gold mining companies).

The above views suggest that the complexity embedded in the gold mining industry in Ghana is not sufficiently well understood or communicated, providing a reason for its full potential not being exploited and hence the benefit for Ghana through economic development and poverty reduction not being realised relative to expectations. This calls for further modelling are in line with the recommendation by Davies and Mabin (2001b) that analyses of a complex system should incorporate multiple perspectives. As indicated, such an approach helps to understand system-wide effects, sometimes undesirable, to support better decision making and improved outcomes from the sector. The limited scope, single-frame analyses used by several previous studies have constituted fundamental limitations that may "stymie efforts to premise policy decisions (about gold mining industry in Ghana) on robust analysis" as noted in a study by the International Council on Mining and Metals (ICMM, 2015, p. 3). It also makes them inadequate to meet the goals suggested by Tsuma (2010), Bloch and Owusu (2012) amongst others.

Figure 1.1: Synthesis of recommendations from previous analyses - Ghana

1.3 Theoretical underpinnings

This study's approach parallels or resonates with critical realism in that it invokes rigorous logic protocols to challenge assumptions about the existence of perceived variables/entities, and any cause-effect relationships between them, and therefore to validate their inclusion in the models developed using the multi-framing approach. Critical realism is based on the belief that reality exists beyond mere observation, and can be defined by entities and the cause-effect relationships between them (Bhaskar, 2009; Fleetwood, 2005). Critical realism also places emphasis on the need to promote synthesis of multiple perspectives even if these are in opposition (Bhaskar, 2009).

As Dobson (1999, p. 268) puts it, a critical realist's approach "recognises the subjective nature of knowledge and argues for the presence of underlying deep mechanisms and enduring structures within the social world." The same notion also underpins most of the frameworks and methods that constitute the multi-framing approach of this study, particularly those drawn from the domain of TOC (Goldratt, 1990). Within the domain of OR/MS and systems thinking (ST), critical realism is recognised with importance. For instance, Mingers (2004) recommends the use of critical realism as the philosophical underpinning of systems-based studies, arguing this helps business schools, and hence managers and practitioners, to engage with practical problems (Mingers, 2015).

Given the complexity and system-wide effects and other characteristics of the gold mining industry in Ghana as highlighted earlier, a critical realist's paradigm is a suitable underpinning for this study. The ontological and epistemological underpinning of TOC and other systems methods have already been well explored (Davies, Mabin, & Balderstone, 2005; Mingers & Brocklesby, 1997). Whilst the methods do not challenge power structures (as some critical realists' advocate) directly, they facilitate problem structuring, and TOC in particular is instrumental from the outset, in critiquing taken-for-granted assumptions and power relations that contribute to core problems (Davies et al., 2005).

1.4 The research framework

"We propose a process which recognises and makes explicit the frame-in-use, which promotes acceptance of the use of multiple frames and the deliberate change of frame – perhaps to provoke the decision maker to consider other possible interpretations of the problem, its objectives, prevailing criteria, existing value judgements, etc., and to widen the possibilities from which the decision maker can ultimately choose" (Davies & Mabin, 2001b, p. 859)

The study is designed to augment the utility of multi-framing by seeking to operationalise the framework of Davies and Mabin (2001b) which takes into consideration the role of context and nature of frames, and the framing processes leading to insight generation and alternative actions. Researchers including these authors have approached multi-framing using multiple complementary systems thinking tools in a mix-and-match manner (Elias, 2016a; Mabin & Davies, 2004; Ormerod, 1995) to inform practice, and contribute to the broader field of OR/MS.

This thesis will contribute to advancing the field by seeking to apply multi-framing using TOC-thinking process tools (TOC-TPS), causal loop modelling (CLM), and stakeholder analysis (SA)

in addition to supply chain and value chain analyses, in sequence and iteratively, working down through layers of various systemic levels of an industry – in this case the gold mining industry in Ghana. By using the methods to inform each other, it also shows the value of individual frames as well as iterating between frames.

1.5 Road map to implementing the research framework

Multi-framing is operationalised taking into consideration the role of context and nature of frames in the framing processes leading to insights generation and alternative actions as Davies and Mabin (2001b) recommended. Three main phases of implementation are involved.

Phase one involves review of contextual analysis of gold mining industry, mapping of industry characteristics to suggested analytical/methodological approaches, and development of a provisional current reality tree (CRT) based on the insights gained.

Phase two is the field research and provides voice to various stakeholders at various levels of the study context (the national, firm and community levels) to share their views about the provisional CRT and making suggestions and recommendations for consideration.

Phase three is implementation of the multi-framing analytical tools recommended for addressing the complexity of issues resulting from the study context. It demonstrates the application of complementary soft systems tools, frameworks in a logical sequence of analysis, using the Change Question Sequence (5CQS) from the field of TOC.

1.6 Structure of the study

The study is made up of 7 chapters, comprising introduction, literature review, research methodology, information gleaned from the field study, multi-framing analysis, discussion, and conclusion. Each of these chapters are briefly outlined below, starting from chapter 2.

Chapter 2: Literature Review

This chapter describes aspects that address the ‘what’ and ‘why’ questions of this study. The literature review covers literature specific to the study context, and relevant methodological and conceptual frameworks. Key contributions of this section to the research process are to identify gaps in the contextual literature for this study to fill; and to identify additional opportunity from previous research for this study to build on and advance.

Chapter 3: Research Methodology

This chapter describes how the study was approached. It identifies and outlines analytical tools, frameworks and methods that were employed to carry out the study and highlights relevant aspects of the research design and the field research. It also reviews literature specific to each of the analytical frameworks or tools implemented in chapter 5 to provide background knowledge and insights prior to applying them.

Chapter 4: Information gleaned from the field study

This chapter reports information gleaned from the field work building on the prior chapters, provides further insights for addressing the first question, and lays a solid foundation for addressing the second question in chapter 5 using multi-framing.

Chapter 5 Multi-Framing Analysis

This chapter operationalises the multi-framing analytical approach of this study. It demonstrates the application of multi-framing to guide how decision makers can logically analyse (identify and understand) and address significant problems limiting desirable outcomes of the industry. It also demonstrates how the multi-framing approach can be adapted to suit the TOC's 'Five change question sequence' (5CQS) methodology. A range of tools are showcased which may serve as a guide to decision makers to analyse and make sound decisions and solve complex problems affecting their practice.

Chapter 6: Discussion

This chapter builds on chapter 5 by discussing findings from the multi-framing analysis of key issues facing stakeholders of the gold mining industry in Ghana and aligns this with the methodological literature. The chapter is structured into two main sections of discussions. The first section discusses insights resulting from the application of each of the multi-framing analytical approaches, whilst the second section reflects on the utility of multi-framing as an analytical approach.

Chapter 7: Conclusion

This chapter reflects, evaluates and elaborates on the implications of the study, outlines key contributions, including practical, methodological and theoretical, and makes recommendations for consideration by key stakeholders of the gold mining industry in Ghana, including mining sector policy decision makers, managers and researchers. It also discusses limitations of the study before concluding by offering suggestions for further research that may extend or complement the approach of this study, in the spirit of providing a platform for sound decision making and problem solving.

1.7 Thesis statement

The challenges facing the gold mining industry in Ghana are complex and multi-dimensional, covering wide-ranging industry issues of varying significance to different stakeholders with different interests which are not always complementary. Political sensitivity and the importance of the gold mining sector for the economy of Ghana add to the complexity. Such industry complexity often translates to managerial complexity, which paired with limited understanding of such complexity, can inhibit the effective solution of significant problems. The industry would be better able to improve and sustain outcomes for stakeholders if policy decision makers, and

managers (and other stakeholders with an interest in the sector), are provided a platform for better understanding to support sound decision making and problem solving about the sector.

1.8 Chapter summary/remarks

This thesis draws on systems-based frameworks drawn both from functional management, for example, the supply chain framework of operations management, and stakeholder framework of strategic management, and from the broad domain of systems thinking (ST) and systems-based methodologies.

The issues limiting desirable outcomes for stakeholders of the gold mining industry in Ghana can be internal or external. The supply chain and stakeholder frameworks allow us to capture the complexity of stakeholders across chain of value-adding activities from ore reserves in Ghana to customers at the other end of the chain. This helps to gain better knowledge, insight and understanding about key issues that may require attention for further analysis from the lens of the systems-based methodologies.

By applying systems-based frameworks and methodologies such as the CLD and TOC frames, further understanding could be gained, and appropriate recommendations made for consideration that may help the industry to improve and enhance its ability to maximise benefit for key stakeholders.

As indicated, whilst the nature of application of the tools and techniques applied in this study are informed by a balance framed by the researcher's understanding and interest, it may stimulate further research to build on, and advance the field.

Chapter 2 : Literature Review

2.1 Introduction

The literature review covers literature specific to the study context, and relevant methodological and conceptual frameworks. Key contributions of this introduction section to the research process are to identify gaps in the contextual literature for this study to address; and to identify additional opportunity from previous research for this study to build on and advance. The section concludes by outlining the study's objectives.

2.2 Literature specific to mining industry in Ghana

This sub-section focuses on previous literature that seeks to analyse the mining industry in Ghana. It is structured to look at issues viewed from different lenses including economic, competitiveness of mining sector in Ghana, community-level linkages and analyses of niche artisanal small-scale gold mining operations. Following this, the characteristics of the industry are highlighted and a synthesis of recommendations from previous studies is offered, before identifying and considering methodological and conceptual frameworks and relevant aspects.

2.2.1 Economic analysis of the mining industry in Ghana

Several studies have sought to build knowledge or 'analyse' the (gold) mining industry in Ghana. Such analyses have focused mainly on the single lens of, for example, the structural adjustment program (SAP) (Akabzaa, 2009; Aryee, 2001; Donkor, 2019; Hilson, 2004; Konadu-Agyemang, 2018). Some of these studies have highlighted, among other things, the economic benefit of (gold) mining to Ghana and the Ghanaian economy that can be attributed to the Ghanaian government SAP initiatives.

For instance, in an economic analysis of the gold mining industry in Ghana, Aryee (2001) found that the industry contributes to a wide range of economic 'indicators' including government revenues, foreign exchange earnings and foreign direct investment² (FDI) as a result of the SAP initiatives. Indeed, by 2011, the Ghana mining industry as a whole had attracted USD 1 billion in FDI compared to just USD 6 million in 1986 before the sector's SAP-related reforms. In the same period, gold production grew more than ten-fold from 287,124 ounces to 3.65 million ounces; bauxite extraction strengthened from 226,461 to 409,929 metric tonnes, with manganese also rising seven-fold from 262,900 to 1,757,387 metric tonnes within same period (Minerals Commission of Ghana, 2015). Also, local purchases made by the LSGM³ sector increased significantly, from USD 52,692,399 in 1996 to USD 172,658,329 in 1998 (Aryee, 2001).

Moreover, an independent analysis was conducted by the International Council on Mining and Metals of the life cycle contribution of the mining industry, using historical data (from 2010 to

² FDI is the term used to describe foreign in-flows resulting from investment of large-scale multinational (gold) mining companies into major mining projects in Ghana

³ LSGM Large scale gold mining

2013), drawn from seven LSGM case study companies in Ghana (ICMM, 2015). The study found that corporate income tax contributed by the case companies over the study period amounted to USD 972 million, with a payroll tax of USD 179 million, and mineral royalties of USD 443 million. Within the same study period, the sector contributed USD 153 million to government as ‘free carried interest’⁴, whilst their contribution to other taxes (not specified) was USD 385 million. Additionally, indirect taxes contributed through the gold mining supply chain (taxes from suppliers and suppliers’ suppliers) amounted to USD 323 million. Thus, within the four-year study period from 2010-2013, the case study companies alone had contributed (directly and indirectly) more than USD 2.4 billion as taxes in Ghana.

Nevertheless, there is an expressed sense of concern that gold mining has contributed less in terms of benefit for, or retained within Ghana, from the SAP, than its social, environmental and economic ‘costs’, and that it has adversely affected the daily lives of Ghanaians generally (Akabzaa & Darimani, 2001; Awudi, 2002). There are suggestions that diverse mining policies, such as a duty waiver on mining imports, have benefitted the LSGM sector to the detriment of development of local economic activities in Ghana (Akabzaa, 2009; Awudi, 2002). These views parallel concerns raised by other governing bodies such as the Commission on Human Rights and Administrative Justice (CHRAJ), quoted in the 2009 Ghana mining report of Business Monitor International (2009, p. 6) that “Ghana’s mining laws are designed to attract foreign investors and not to protect the rights of local communities”. Also, Aubynn (2017), a former Chief Executive Officer of the Minerals Commission of Ghana adds an insider perspective about regulatory challenges of the industry that limits the full potential of the SAP. He identified a lack of strong political will amongst regulators, and interference by political actors, as the main issues faced by the industry.

In addition, the Minerals Commission of Ghana (2015) has highlighted a number of issues facing the (gold) mining industry in Ghana, key amongst which are: environmental concerns from mining, an imbalanced distribution of mining benefits to stakeholders, lack of integration of mining with other economic sectors, and the leakage of profit and funding streams to offshore destinations and thus, lower levels of retained benefits derived from the gold mining sector in Ghana.

2.2.2 Competitiveness of mining industry

In recognition of the significant contribution of the minerals (mining) sector to foreign exchange and GDP in Ghana, Amponsah-Tawiah and Dartey-Baah (2011) for example, suggested that a competitive mining regime based on greater economic equality, mutual benefit and in accordance with generally accepted notions of fairness, would allow Ghana and other resource-rich developing countries in Africa, to maintain and improve sector benefits, particularly within the global context in which the industry operates. To explain their position about whether gold mining is a curse or a blessing, the authors delineate their views, first suggesting that mining could be a blessing if a win-win environment exists, that is based on fairness. Then they express concern that some researchers and other Non-Governmental Organisations (NGOs) make mining look like a curse,

⁴ Free carried interest: Having shareholding right without financial involvement/obligation

creating challenges for mining companies and discouraging their operations in developing countries, including Ghana.

In an earlier analysis of the global competitiveness of the mining industry in Ghana, Ayisi (2010) noticed that Ghana's legal regime, based on the Minerals and Mining Act (MMA)⁵, 2006 (Act, 703) brought the country closer to countries such as Latin America and Chile with attractive legal frameworks and provisions for mining that are considered as international best practice, particularly from a neo-liberal perspective. However, in a subsequent analysis, Ayisi (2015) discussed changes that have taken place in the fiscal regime and examined the effect of such changes on the attractiveness of the gold mining industry in Ghana. He suggested that the revisions to fiscal aspects such as a corporate income tax, from 25% to 35%, and the imposition in early 2009 of a 5% royalty rate to replace the 3-6% sliding rate, violates existing stability commitments to mining companies, and exposes such companies to investment risks and uncertainties instead of protecting them. Whilst recognising the new reforms as commendable effort, Ayisi (2015) also suggests there is room for improvement. He implied that the Ghanaian Government may need to consider improving the overall performance of the mining legal regime rather than targeting component parts as it does currently. The above recommendation resonates with the view of this study, as will later become more evident in the discussions in Chapter 6 and the recommendations section in Chapter 7.

In a comparative analysis of various mining regimes including PNDC Law 153, the Minerals and Mining Act, 2006 (Act 703) and the Minerals and Mining (Amendment) Act (MMAA)⁶ 2010 (Act, 794), Eshun (2018) implied that the approach taken by the Government is justified. He acknowledged that the industry was more competitive under the MMA, 2006 (Act 703) compared to others such as MMAA, 2010 (the Act/regime as suggested by (Ayisi, 2010)). However, he argued that the reforms reflect contemporary trends in 'good practice' and are needed to maximise Ghana's benefit from the gold mining sector, particularly when prices of gold and production levels increase. He suggests that mining companies should find possible means of effectively managing likely risks that such reforms may have on the sector's operations, including seeking to establish 'stability agreements' with the Government.

Others have shed light on other aspects limiting the competitiveness of the industry and raised concerns about consequences that reflect an awareness that the gold mining industry, like any organisational sector, is characterised by complexity in terms of its system-wide effects.

As Smith (2016) suggests, for example, that in addition to constraints internal to the sector or Ghana, mining companies are often faced by external factors such as a decline in the prices of gold which is beyond the direct control of the industry. The risks are intensified when mining companies have to deal with unfavourable market conditions alongside internal constraints such as unfavourable tax regimes by the Government. This has consequences that may include decreasing

⁵ MMA Minerals and Mining Act

⁶ MMAA: Minerals and Mining Amendment Act

revenues and reducing the profitability of mining companies (Smith, 2016). As that author implies, decreases in revenues and profitability of mining companies have implications such as limiting the extent of benefits that Ghana can derive from the sector through royalties, taxes and dividends (Smith, 2016).

In addition, a study by Atta (2019) suggests that the gold mining industry is not cost competitive considering that the average cost of operations of the sector exceeds the global average, an issue that he noted as having adverse impact not only on mining companies but also on Ghana's benefit. Atta expressed concern that most companies struggle to realise their economic goals and have had to lay off a significant number of employees as a result of the industry's lack of cost competitiveness.

Atta (2019) and others imply that maintaining the current fiscal regime is not advisable (Atta, 2019; Ayisi, 2015; Smith, 2016). They believe that Ghana's full economic potential of its gold mining will not be unlocked if it continues to promote the use of frameworks such as the current fiscal regime that fails to offer a solution to key issues that affect the industry as whole.

This runs counter to the view, held by the Ghanaian Government and others, that government should maintain the fiscal regime in order to maximise Ghana's benefit from the sector (Eshun, 2018). The Ghanaian Government has expressed concern that there is a systematic under-valuation of royalties and profits by mining companies which is making it difficult for it to maximise revenues to the state. Consequently, the Government has made the decision to promote the use of aggressive strategies, including the use of fiscal policies, that would facilitate the ability of Ghana to protect and maximise revenues to the state (Government of Ghana, 2019), in clear conflict with the views of Atta (2019) and other analysts

2.2.3 Development of mining linkages

With the 'Africa Mining Vision' (AMV) (African Union, 2009) growing in recognition and acceptance, increasingly more attention and emphasis is made by researchers and governments of resource-rich African countries like Ghana to prioritise the development of local economic activities directly (or indirectly) linked to the mining supply chains and their value chains.

The President of Ghana makes his intentions for a supply/value chain approach clear whenever he gets the platform. At the 2018 West African Energy and Mining Exhibitions Conference for example, he hinted at his intention for a value chain approach referring to it as new paradigm of an integrated economic development driven by the mining industry (Ghana Chamber of Mines, 2018). The gold mining sector is one of the main focuses for this goal. In addition to a National Assay Programme, the President identified other factors that are critical, including the provision of a reliable and competitive power supply, minimising the export of raw materials, and preventing leakages of value throughout value chain.

As part of efforts to prevent leakages, the National Suppliers' Development Program (NSDP) was launched (Ghana News Agency, 2017). It is considered that the NSDP would strengthen the

capability of local suppliers (Ghanaian businesses) to spot and exploit more benefits from low-hanging ('quick hit') opportunities within the mining supply or value chain such as in-country spending of mining companies which constitutes about USD 1.2 billion a year. It is also considered that the NSDP would facilitate strengthening of existing local content policies at both the national and industry levels, allow for value-adding activities to be undertaken across the supply chain (particularly downstream) of gold mining and other economic sectors, including the petrochemical industry and the consumer goods industry. Additionally, the NSDP would facilitate implementation of the 'Africa Mining Vision', and ultimately establish the international competitiveness of Ghana as an attractive destination for mining companies and other investors.

Similarly, the Ghana Chamber of Mines, as a national body representing the interest of operating companies, opines that in addition to managing revenues strategically, it is critical to harness linkage opportunities as these have the potential to maximise the sector's benefit not only to mining communities but to Ghana as a whole (Ghana Chamber of Mines, 2019, p. 22).

The above views reflect the suggestions by the ICMM (2015) that Ghana could benefit more from its gold mining by seeking to increase procurement from local business and service operators by about 25% and developing a national action plan to back local purchases rather than relying on fiscal revenues. They imply that Ghana could capture more value for stakeholders by focusing on indirect benefits (possible through strengthening of local content procurement and linkages) unlike the fiscal benefit which to some extent, is limited to the state.

2.2.4 Community-level analysis

Given that gold mining can be both economically beneficial and environmentally threatening with adverse implications for biodiversity loss and human health problems (Hilson & Nyame, 2006; Tuokuu, 2019), a significant number of studies about the gold mining industry in Ghana have paid attention to analysing aspects that may have a bearing on stakeholders, particularly members of mining communities. Some of these studies are general, often seeking to analyse the impact of the mining industry from the perspectives of members of mining communities, whilst others relate to CSR as providing a solution to key issues that surface as concerns of stakeholders. Some of these studies are reviewed below.

2.2.4.1 Studies that consider stakeholder perspectives

There are several studies covering a wide range of topical issues that could be considered under this heading. However, studies such as Bugri and Kumi (2018); Garvin, McGee, Smoyer-Tomic, and Aubynn (2009); Hira and Busumtwi-Sam (2018); Taabazuing, Luginaah, Djietror, and Otiso (2012); Tuokuu (2019) are noteworthy. They offer complementary insights about the perception of stakeholders on issues ranging from economic, social and environmental impact at the community level, and share important views which could inform further analysis.

In their analysis of the perception of the impact of mining activities on the everyday life of members of mining communities, Taabazuing et al. (2012) drew from the lens of livelihood

compensation to analyse the perceptions of adversely affected members of mining communities. The authors noted that although adversely affected sources of livelihood of community members are compensated through the community livelihood compensation scheme, the scheme does not take into consideration factors such as the investment cost and losses. They also noted that members of the mining community feel that they lack the support of institutions such as the Land Valuation Board (LVB) as such bodies are perceived to align with the interest of mining companies. Using a similar approach, Bugri and Kumi (2018) noted a difference in perception between mining companies and their host communities about the effectiveness of compensation practices. They identified issues such as weak enforcement of mining policies, and the lack of or limited negotiation power on the part of mining communities that may need to be addressed in order to make progress towards improvement.

The issues above reflect weaknesses in the policy environment, a view shared by others (Garvin et al., 2009; Taabazuing et al., 2012). Garvin et al. (2009) identified issues such as conflicting roles and responsibilities, poor communication and lack of coordination among institutional bodies linked to the mining sector that are limiting the effective implementation of mining policies even where they exist. Other factors were also noted by the authors, including the lack of perceived meaningful engagement with communities. In an aspect that has implication for a reliance on CSR-related solutions to economic development and poverty reduction in mining communities, some scholars, including Garvin et al. (2009) have implied that the action (or inaction) by government agencies at all levels has led mining companies to act as a surrogate to government through the provision of developmental projects. However, promises of CSR projects by mining companies often result in a heightened community expectation, and when companies are unable to live up to such expectations, tend to blame communities for being overly demanding (Garvin et al., 2009).

From an environmental perspective, Tuokuu, Idemudia, Gruber, and Kayira (2019) suggested that whilst gold mining may have contributed to social and economic development in Ghana, it has also led to adverse consequences, including environmental degradation, and in some cases, violation of the fundamental human rights of mining communities. The authors attributed the problem to a neglect of views of critical stakeholders, poor design and lack of effective implementation of environmental policies, which have in turn given rise to a number of factors, namely: conflicting expectations of stakeholders with regard to environmental issues and how they could be managed, blaming (problems) responsibility on others, and disconnection within the regulatory system.

In a separate study of community benefit agreements (CBAs⁷), Hira and Busumtwi-Sam (2018) similarly noted that members from the host communities of the companies they studied expressed frustrations and raised concerns about the impact of mining activities, sharing a negative

⁷ Community benefit agreements (CBAs) – a formal (informal) agreement between a mining company outside traditional regulatory requirement, to guarantee community support for operations in return for needed socio-economic and livelihood project and support

perception about mining companies in relation to expected benefit of the sector's activities. Garvin et al. (2009) reports a study of communities having relationships with mining companies. When asked to rate their relationship based on what they think about the economic, social, and environmental impact of their activities, managers of companies gave a positive rating for all key dimensions, suggesting that they consider their relationship with mining companies to be positive. On the other hand, members of the host communities, whilst agreeing to some extent on some dimensions of the environmental and social impact (rated negative for others), gave an entirely negative rating for the economic impact (Garvin et al., 2009).

The above issues have implications for the nature of relations among mining sector stakeholders. For example, Taabazuing et al. (2012) revealed that the lack of attention towards the concerns raised by mining communities about the sector's compensation scheme have often resulted in a situation of conflict among stakeholders. Indeed, when it came to compensation for livelihoods, members of mining communities suggested minimal or no trust for mining companies or institutional bodies, including local governing bodies such as the LVB. However, mining companies seem to be unaware or fail to realise that mining communities view the impact of their mining activities differently from the way that mining companies would want or want to be seen.

Hence, the authors proposed that in order to manage the risks, mining communities need to be involved in decision making on issues that affect them. In addition, they emphasised an implied need for decision makers to find appropriate means to address unresolved issues reflecting as conflicts of interest in order to enhance the contribution and impact that gold mining makes in Ghana (Taabazuing et al., 2012). This is consistent with the recommendation by Garvin et al. (2009) who argue for the involvement of mining communities in the negotiation processes leading to the development of mining projects and providing key stakeholders a voice in decision making processes in a more effective way.

Hira and Busumtwi-Sam (2018) imply that we can address the sector's challenges by effectively managing CBAs, possible through formalisation. They noted that in some gold producing developed countries, including Canada and elsewhere, such CBAs are a requirement and enable mining companies to generate community support to operate through the benefits they agree to provide. However, in the context of the gold mining industry in Ghana, CBAs have been embraced by the studied gold mining companies as a voluntary concept, lacking any formal requirement and hence, they are not managed adequately (Hira & Busumtwi-Sam, 2018).

According to Tuokuu et al. (2019), the industry must ensure effective implementation of needed changes, promote broader consultation and partnership among stakeholders, and ensure companies are responsive to the needs of mining communities. Finally, from the perspectives of mining communities, Tuokuu et al. suggest that the adverse impact of gold mining could be managed by reducing mining activities to free up lands for agricultural activities such as farming which is the traditional source of livelihood of these communities (Taabazuing et al., 2012).

2.2.4.2 Corporate social responsibility (CSR) – a solution?

As indicated above, adoption of Corporate Social Responsibility (CSR) values, policies and projects has frequently been suggested as a means of addressing the above problems. Medinilla (2016) suggests that CSR projects, particularly those focusing on alternative livelihood projects such as the Bogoso Oil Palm Plantation (BOPP) project, have the capability to create value for stakeholders and lead to the sustainable development goals agenda, if well managed. In particular, Medinilla recommended the need for a partnership approach to CSR that brings together key stakeholders, including civil society, mining companies and mining communities. He suggests this implies a need for companies to transition from a business-case orientation underpinning CSR to a strategic partnership (win-win) approach.

From a practitioner perspective, Mireku-Gyimah and Gyamfi (2016) described the evolution of CSR of Golden Star Resources (GSR) Limited in a way that suggests or reflects a commitment to transition from a business-case to a partnership approach as emphasised by Medinilla (2016). Its CSR approach known as the Corporate Social Responsibility Agreement Model (CSRAM) is not just strategic, it is established on agreement between the company and host communities, allowing GSR to achieve transparency, accountability and trust, and mutual understanding with host communities. Achieving such outcomes is critical for successful implementation of a strategic CSR such as the CSRAM approach. It has been claimed that the CSRAM has benefited not only mining communities in terms of allowing them to have a voice in the funding and selection of CSR projects, but also been of considerable benefit to GSR, including facilitating the commissioning of its Prestea underground mine as well as enabling the smooth organisation of “a public hearing on the Prestea South Mbease Nsuta Open Pit Project” (Mireku-Gyimah & Gyamfi, 2016, p. 103).

The above benefits from CSR are significant, particularly for GSR, considering for example that, in the past, the company had faced operational conflict from strained relationships between it and the artisanal small-scale miners from the host communities (Hilson & Yakovleva, 2007). Perhaps using the CSRAM played a key role in strengthening interactions between GSR and the community. Thus the CSRAM approach seems to be more effective and hence, better suited for managing relationships with stakeholders than approaching CSR from the traditional philanthropic approach in other parts of the industry as Mireku-Gyimah and Gyamfi (2016) implied.

Nevertheless, there is a stated acknowledgement of challenges to the company’s strategic CSRAM model, including an observed difficulty of enforcing compliance with the agreement, and raising expectations/demand for jobs that are unavailable (Mireku-Gyimah & Gyamfi, 2016). Such challenges have implications for CSR-related approaches as many scholars seem to argue (Campbell, 2012; Garvin et al., 2009). As highlighted earlier, Garvin et al. (2009) claimed that in seeking to achieve their business goals, mining companies often make some needless promises for infrastructural development projects through CSR. Such CSR promises tend to draw the attention of mining communities and increase expectations. However, in some cases, these companies may fail to live up to the CSR promises but fail to realise that they are part of the problem, and thus, blaming communities for being too demanding. Similarly, as suggested elsewhere (Campbell, 2012), CSR

activities may only legitimate the activities of mining companies rather than being well-suited for addressing problems. Campbell additionally noted that relying on a CSR-related solution may conceal the complexity embedded in issues facing the mining industry, and make it difficult, if not impossible, to identify the root causes or actual problems underlying the issues that affect sector stakeholders.

2.2.5 Analysis of the ‘niche’ ASSGM sector

Any industry which is dominated by a small number of large organisations may provide opportunities for niche operations to act in an entrepreneurial fashion. Such a scenario is reflected in the Ghanaian gold mining sector, with impoverished communities trying to make a living out of artisanal small-scale gold mining (ASSGM⁸) operations. Most of these ASSGM organisations operate outside of legal frameworks. Their presence is recognised and, in the past, has been tolerated inasmuch as they contribute a significant minority of gold output.

Statistics provided by the Minerals Commission of Ghana (2015), suggests that the ASSGM sector, (comprised of about 95 percent of Galamsey operators) has contributed significantly to total gold exports for the country, for about two and half decades, while statistics from the Ghana Chamber of Mines suggest that the sector contributed almost half (41.4%) of total output in 2018 (Ghana Chamber of Mines, 2019). Such production is widely acknowledged and continues, despite environmental concerns arising from activities of the ASSGM sector which have led to government action to prohibit the sector’s activities, particularly the Galamsey⁹ operations (Hilson & Hilson, 2017).

Also, whilst informal relationships exist between the LSGM and ASSGM sectors, these are often characterised by operational conflicts (Aubynn, 2009; Hilson & Yakovleva, 2007). Indeed, even if such informal relationships are breached or not upheld, then conflict arises with mining communities, often creating an implied need, and hence, calls for a formal mechanism to address the breaches/concerns of the affected party (Adonteng-Kissi & Adonteng-Kissi, 2017; Garvin et al., 2009).

In a study of Ghana’s ASSGM, conducted with an espoused intent to promote a multi-stakeholder dialogue and formalisation, McQuilken and Hilson (2016) highlighted the importance of ASSGM as contributing significantly to employment and livelihoods. They noted that at least 1 million Ghanaians are employed in the ASSGM sector, who provide for an estimated 4.5 million or more dependents, yet the sector remains under-developed to date. Findings from other studies also suggest that the de facto prioritisation of LSGM sector has led not only to an unwitting lack of attention to formalisation/regulation of the ASSGM sector, but also to the adoption or continuation by the ASSGM sector of more informal Galamsey activities and practices (Teschner, 2012),

⁸ ASSGM – Artisanal small-scale gold mining is a generic term used to describe the formal small-scale gold mining and informal small-scale gold mining sub-sectors. Otherwise, the latter is referred to as Galamsey whilst the former is referred to as small scale gold mining (SSGM)

⁹ Galamsey literally means gather and sell

including unsafe production methods. In turn, such methods have been described as endangering not only the environment, and the safety and wellbeing of such miners themselves, but also of the wider mining community (Hilson, 2002; Tschakert, 2009).

The ‘issue of Galamsey’ has developed to the critical extent that it has become a nationwide concern, generating tension at varying levels – national, industry, and firm and community levels, reflecting the multiplicity of stakeholders affected. As a result, Government was forced to order a temporary closedown of the sector in 2017 using military interventions and task forces, an action that some researchers, including Hilson (2017), claim resulted in shootings and the burning of heavy mining equipment such as excavators. Hilson also raised concerns about the high rate of youth unemployment in Ghana, drawing on the UN Human Development Index to argue that the youth unemployment rate in Ghana is considerably high, and leaving its youth to struggle for employment does not reflect the country’s rating as a middle-income developing country. This view suggests that the ASSGM sector (including Galamsey) serves as a practical alternative for poverty-driven mining operators in Ghana.

2.3 Characteristics of the gold mining industry

In summary, this brief review suggests an awareness that:

- ❖ *Gold mining can be both economically attractive and environmentally damaging, with adverse effects on human health and biodiversity loss. Hence, different stakeholders, that is the state, communities and investors, have different interests, demands, expectations and wishes, when it comes to mining and its benefits.*
- ❖ *Foreign Direct Investment may foster large-scale gold mining projects but limits development of local economic activities such as the small-scale gold mining sector, and other local businesses associated with the gold mining value/supply chain in Ghana with economic, social and environmental consequences.*
- ❖ *There seem to be leakages in the gold mining value/supply chain which threaten the Ghanaian contribution to sustainability of the industry.*

The mining industry is characterised by complexity in terms of its extended/sequential operations, its system-wide reach, its multiple stakeholders, and the variety of formal and informal organisations that constitute the industry. The above characteristics are complex and multi-dimensional, covering wide-ranging industry issues of varying significance to different stakeholders with different interests which are not always complementary. Such industry complexity often translates to managerial complexity, which paired with limited understanding of such complexity, can inhibit the effective solution of significant problems. This is particularly so because gold mining can be both economically attractive and environmentally threatening, with adverse impacts for example, on human health and biodiversity loss.

Hence, different stakeholders, that is the state, mining communities and investors, have different interests, demands, expectations and wishes, when it comes to gold mining and its benefits. As

stated above, such industry complexity can often impact managerial complexity and affect desirable outcomes from the sector if not well-managed.

Thus, analyses of the industry should incorporate multiple perspectives to capture multiple stakeholders' interests and understand system-wide effects (sometimes undesirable), to support better management and sound decision making towards improved outcomes for disparate stakeholders of the sector. Before considering prior industry analyses exploring the above characteristics, it would be necessary to provide a brief review of literature on comparable mining-based economies that have addressed some of the underlying issues highlighted. Such insight could be helpful in discussing potential directions for improvement arising from the primary research of this study. Hence, a review of comparable mining-based economies is considered next.

2.4 Review of comparable mining-based economies

There are two main approaches evident in the literature on how mining/resource-based economies, on different continents, address obstacles and increase potential outcomes from the sector. One approach utilises sovereign wealth funds, whilst the other approach relates to strengthening of linkages. Key examples of each of these approaches are considered as follows.

2.4.1 Key examples of using Sovereign wealth funds to benefit economies and citizens

A sovereign wealth fund (SWF) can be considered as a state-owned fund of money generated by governments from a country's surplus reserves to ultimately benefits its economy and the people. It noted that sovereign wealth funds evolved from stabilisation funds to stand-alone management funds, and there are various means through which a country may generate its SWFs (Megginson & Fotak, 2015). The main source of SWFs include balance of payment surpluses, bank reserves/fiscal surpluses, money derived from proceeds of privatisation, and surpluses from export of resources, to highlight a few (Megginson & Fotak, 2015).

In the context of this study, attention is focused on SWFs in relation to surpluses of money derived from a country's resources sector. The profile of countries that have established SWFs as a way of maximising the potential of the mining/resource sectors in the world is provided in a comparative study (Alsweilem, Cummine, Rietveld, & Tweedie, 2015). Amongst the more successful SWFs highlighted are the Norwegian Government Pension Fund Global (GPF), and the Chilean Pension Reserve and Economic Stabilisation Funds. In the context of Africa, the Public Investment Corporation of South Africa, and the Pula Fund of Botswana are also recognised (Alsweilem et al., 2015).

Dixon and Monk (2011) in their analysis of SWFs suggest that resource-endowed developing and emerging economies often face challenges arising from weak institutions and corruption that limits desirable outcomes, such as improving living standards of the people, from the minerals' wealth. They refer to the Minerals Resource Stabilisation Fund (MRSF) of Papua New Guinea, and the Future Generations Fund (FGF) of Chad, attributing their failures to corruption, political interference, and economic mismanagement. Such issues, according to Dixon and Monk (2011),

reflect particular governance challenges, some of which could be addressed by allowing SWFs of resource-endowed developing countries to be independently governed.

Drawing on the examples of the Petroleum Fund (PF) of Timor-Leste and the Government Pension Fund Global (GPF) of Norway, Dixon and Monk (2011) suggest that these SWFs, as some of the most successful cases, have design features that could be adapted by developing countries. The PF, for example, is managed independently by a separate Banking and Payment Authority which has the responsibility for the receipt and disbursement of minerals wealth from the fund to the national budget for domestic spending.

Like the PF, the GPF is effectively managed by the Norges Bank, and both SWFs are additionally characterised by a focus on saving/accumulating funds for the future, in particular, a rainy-day future. However, a fundamental feature of the GPF that contributes to its high regard and global recognition, is its ethical commitment. For example, it is noted that the GPF has a “two-sided ethical commitment” (Clark & Monk, 2010). One ‘side’ relates to how it approaches corporate engagement, doing so in accordance with globally-recognised best-practice corporate governance principles, whilst the other involves ensuring protection from actions that may pose risk in terms of contributing to global social and environmental injustices (Clark & Monk, 2010).

Evaluating the success of the GPF for example, the authors imply that factors such as the strong institutional capacity of the Norges Bank, ethical governance and responsible investment are the core features characterised by successful management of SWFs in resource-based advanced economies, particularly Norway (Clark & Monk, 2010; Dixon & Monk, 2011).

Regarding a commitment to global ethical standards, for example, the Norges Bank Investment Management (NBIM) have acted on the recommendations of its ethics committee, excluding four companies from the GPF (NBIM, 2021). These include the India State-owned Oil and Natural Gas Corp due to its supposed ties with groups considered to violate human rights in South Sudan. The others, including Elco Limited, Ashtrom Group Limited, and Electra Limited, have been characterised with systematic violation of individual rights in situations of war or conflict linked primarily to the Israeli settlements on the West Bank.

Information available publicly on the website of the Sovereign Wealth Fund Institute (using the search word “Ghana¹⁰”) reveals that Ghana has demonstrated an implied intent to effectively manage revenues, through the establishment of three main SWFs, ranking amongst the top 100 SWFs in the world (see ranking¹¹ for top 100 largest SWFs). These are the Ghana Heritage Fund (GHF) at 76th position followed by the Ghana Infrastructure Investment Fund (GIIF) at 82nd and the Ghana Stabilisation Fund (GSF) which ranks 87th in the world. It must be noted, however, that not all SWFs can be linked to the mineral/resource sector. For example, a survey of SWFs by

¹⁰ <https://www.swfinstitute.org/profiles>

¹¹ <https://www.swfinstitute.org/fund-rankings/sovereign-wealth-fund>

Meggison and Fotak (2015) suggests that we can distinguish between these funds based on the principal sources of the funding; some are linked to the resource sector whilst others are not. SWFs such as the Government of Singapore Investment Corporation (GSIC), the New Zealand Superannuation Fund (NZSF) and the China Investment Corporation (CIC) have sources of funding that are not linked to commodity markets and revenues. Instead, they are funded by trade surpluses.

In Ghana's case, it is suggested that the GHF and GSF are linked to the resource sector through the Ghana Petroleum Revenue Fund (PRF), receiving a portion of the oil revenue each year (see link¹² below for more information, including the nature of the fund, its management, performance some and challenges). There is little or no evidence to establish a relationship between the GHF, GSF or GIIF and the gold mining sector. Evidence from the literature instead suggests that Ghana manages revenues from the mining sector through benefits-sharing that is governed by the Minerals Development Fund (MDF)¹³ and the Minerals Income Investment Fund (MIIF), 2018 (Act 978)¹⁴. However, unlike the MDF which is aimed at benefits-sharing of about 20 percent of revenues from the sector to stakeholders (communities and mining institutions), the MIIF is an investment fund only in name. In fact, its main purpose is to provide the government with advances (loans) on future royalty income unlike the PRF which serves as a source of funding for the country's SWFs (i.e. the GHF and GSF).

Thus the MIIF primarily seeks to monetise (or securitise) future minerals income to provide government access to funds for infrastructure projects, based on anticipated royalties from the gold mining sector (Government of Ghana, 2018). Whilst flawed, this is seen as a better alternative to other sources of loans, such as the IMF, capital markets and international bond markets (see Ghanaweb.com)¹⁵.

The MIIF is managed by the Agyapa Royalty Company Limited (ARCL). The management of the MIIF through the ARCL has implications for stakeholder dynamics of the industry, an issue that can be better understood using a dynamic level stakeholder analysis approach (Mitchell, Agle, & Wood, 1997). Such an analysis is provided in Table 5.8 under section 5.2.5.2. The second approach adopted by countries to increase potential beneficial outcomes from the sector, namely by promoting the development of linkages with and within the sector, is considered next.

¹² <https://ghaudit.org/web/wp-content/uploads/2020/06/Petroleum-Fund-2018.pdf>

¹³ <http://www.mlnr.gov.gh/wp-content/uploads/2019/06/Mineral-Development-Fund-Act-2016-Act-912-1.pdf>

¹⁴ [https://www.bcp.gov.gh/acc/registry/docs/MINERALS%20INCOME%20INVESTMENT%20FUND%20ACT,%202018%20\(Act%20978.pdf](https://www.bcp.gov.gh/acc/registry/docs/MINERALS%20INCOME%20INVESTMENT%20FUND%20ACT,%202018%20(Act%20978.pdf)

¹⁵ <https://www.ghanaweb.com/GhanaHomePage/business/What-you-need-to-know-about-Agyapa-Royalties-deal-and-the-controversies-1045648>

2.4.2 Some examples of countries capturing value through development of linkages

Whilst some minerals and resource-endowed economies use SWFs as a means of sustaining and developing the end-value revenues arising from the sector, others focus on the strengthening of linkages, using legislative policies that allow them to capture value from throughout the minerals and resource sector value chain. Some of these legislative policies are aimed at upstream activities, requiring certain items and services to be supplied locally (Korinek & Ramdoo, 2017; Toledano & Maennling, 2018), whilst others encourage in-country processing of downstream value-adding activities (Fliess, Idsardi, & Rossouw, 2017). These approaches are not mutually exclusive.

Ghana is considered to be one of the resource-endowed economies in Africa that uses the latter value-capturing strategy to address obstacles and increase potential outcomes from the mining sector, along with others including South Africa, Liberia, and Mozambique (Korinek & Ramdoo, 2017). In the global context, those authors also recognise Canada and Brazil, Finland, then Australia, Papua New Guinea and Peru as embracing the notion of value capturing.

It is noted, however, that whilst the value-capturing strategy seems to work well amongst the more advanced economies like Canada and Australia, in the context of Africa most countries using the approach, including Ghana, are less likely to succeed despite high expectations backed by implementation of clearly-defined legislative policies (Korinek & Ramdoo, 2017).

For example, a historical account of mining legal regimes is provided by Aryee (2018), touching on aspects such as the Minerals and Mining Act, 2006 (Act 703) and subsequent versions such as the Minerals and Mining (Amendment) Act, 2010 (Act 794; Minerals and Mining (Amendment) Act, 2015 (Act, 900) as the legal framework which governs the fiscal regime of mining investments in Ghana. Supporting this legal framework are legislative instruments such as the Minerals and Mining (*General*) Regulations, 2012 (L.I. 2173)¹⁶, developed specifically to protect Ghana's (gold) mining value chain. Other legislative instruments are dedicated to specific aspects such as the Minerals and Mining (*Support Services*) Regulations, 2012 (L.I. 2174)¹⁷; Minerals and Mining (*Compensation and Resettlement*) Regulations, 2012 (L.I. 2175)¹⁸; Minerals and Mining (*licensing*) Regulations, 2012 (L.I. 2176)¹⁹; the Minerals and Mining (*Explosives*) Regulations,

¹⁶ <http://extwprlegs1.fao.org/docs/pdf/gha168926.pdf>

¹⁷ <https://www.documents.clientearth.org/wp-content/uploads/library/2012-03-20-minerals-and-mining-support-services-regulations-2012-l.i.-2174-ext-en.pdf>

¹⁸ <https://www.documents.clientearth.org/wp-content/uploads/library/2012-03-20-minerals-and-mining-compensation-and-resettlement-regulations-2012-l.i.-2175-ext-en.pdf>

¹⁹ [Minerals-and-Mining-Licensing-Regulations-2012-L.-I.-2176.pdf \(mincom.gov.gh\)](#)

2012 (L.I. 2177)²⁰, and the Minerals and Mining (*Health and Safety and Technical*) Regulations, 2012 (L.I.2182)²¹.

From the legal frameworks highlighted above, Ghana seems to have a well-developed legal policy/institutional infrastructure, contrary to concerns about such issues by most scholars, including (Armah, Luginaah, Yengoh, Taabazuing, & Yawson, 2014; Taabazuing et al., 2012) that the policy environment is imbalanced, favouring mining companies at the detriment of mining communities and hence, ill-effective.

Nevertheless, like most African countries seeking to capture more value from the mining sector, Ghana struggles to realise desired goal(s) as the study by Korinek and Ramdoo (2017) suggests. The inability of Ghana and other African countries to realise desired outcomes seems to confirm an implied view that whilst seeking to capture additional value from mining and resources is necessary, it is not sufficient unless accompanied by an effective, well-developed mining sector and subsequently, creating a circular transformation of value from the sector into long-term development (Dobbs et al., 2013).

2.4.3 Key insights from the sovereign wealth fund versus value-capturing approaches

A key insight from the sovereign wealth fund and value-capturing literature reviewed above is that regardless of which approach is used by resource-endowed economies to maximise benefits from the sector, they must develop the necessary infrastructure (both hard and soft infrastructure) to ultimately manage value derived from the sector for sustainable development.

The concept of managing value from the sector for long-term development has implications for sustainability and sector benefit that could be better understood in terms of the global, SDGs context as promoted by the United Nations Development Program UNDP (2016). Indeed, the UNDP and its partner institutions agree that we can use natural resources as the basis for broad-based sustainable development. These partner institutions include the Columbia Center on Sustainable Development, the United Nations Sustainable Development Solutions Network, and the World Economic Forum. These bodies have jointly mapped the positive and negative impacts of mining activities against each of the recommended SDG goals, identifying opportunities to maximise benefits and minimise adverse impacts of investment in the resource sectors (UNDP, 2016).

Given the systemic complexity of SDG goals and dimensions, there are many decisions to be made when thinking about maximising Ghana's benefits from the mining sector, adding to managerial complexity. Hence, a framework is required that can help Ghana to promote better management and sound decision making about mining investment to enhance success.

²⁰ <http://extwprlegs1.fao.org/docs/pdf/gha168928.pdf>

²¹ <http://extwprlegs1.fao.org/docs/pdf/gha168930.pdf>

A review of studies that explore the complex characteristics exhibited by the gold mining industry in Ghana is thus considered next.

2.5 Prior industry analyses exploring the above characteristics

In order to improve analyses of the industry, we need frameworks appropriate to the task. Table 2.1 below identifies a range of methods that have been developed for the characteristics mentioned under section 2.3, with selected key references.

Table 2.1: Mapping of gold mining industry characteristics to suggested methodological approaches

Aspects of complexity in the gold mining industry	Methodological Approach	Methods/Tools
Multiple Stakeholders	Stakeholder Analysis (Freeman, 1984; Mitchell et al, 1997; Elias, Cavana & Jackson, 2002)	Stakeholder Analysis
Extended/Sequential Operations	Supply Chain/Value Chain Approach (Porter, 1985, 1990; Schragenheim et al, 2009; Lambert et al, 2017; Görner et al, 2020)	Supply Chain analysis/ Value Chain Analysis
System-wide Effects	CLD/SD (Senge 1990; Maani & Cavana, 2007) TOC management Approach (Goldratt, 1994, Dettmer, 2007)	CLDs and Systems Archetypes, BOT, TOC-Thinking process tools
Multiple Levels/Aspects	Mixed methods (Davies & Mabin, 2001; Mabin & Davies, 2004; Mingers & Gill, 1997)	Multi-framing Multi-methodology

The following sub-sections review contextual literature that relate to the suggested methods and frameworks for analysing aspects of complexity exhibited by the gold mining industry in order to identify research gaps. They relate to studies of stakeholders involving or using stakeholder analysis, studies of extended/sequential operations that reflect supply chain or value chain analysis, studies that are systems-based (including causal loop diagramming, and TOC approaches), and studies that reflect Multi-framing. The coverage herein aims to provide a brief overview of applications of such methods, as well as any extant examples of applications to gold mining in Ghana or similar contexts.

2.5.1 Previous studies of stakeholders using Stakeholder Analysis

In the context of mining and other resource sectors, the importance for understanding and managing the interest of key stakeholders seems to coincide with the trend towards adoption of the UN sustainable development goals agenda (Brundtland & Khalid, 1987) and the requirement for the sector to be more engaged in socially and environmentally responsible mining and consumption.

For example, it has been claimed that addressing such sustainability issues will affect decision-making process in all phases of current and new projects in the sector (Starke, 2002). Other stakeholders, including researchers, professional institutions, industry bodies, NGOs amongst others, have demonstrated added interest in the subject, and provided further advocacy for additional dimensions of a larger sustainability-umbrella. These topical issues include gender, human rights and community development, cultural heritage and social impact (Hill, Madden, & Collins, 2017; Kemp & Keenan, 2010). Such sustainability dimensions also reflects changes taking place in the specific context of Ghana towards a growing focus and emphasis on CSR for managing relationships with stakeholders (Medinilla, 2016; Mireku-Gyimah & Gyamfi, 2016).

However, a study that examines CSR in the context of the mining industry observes that sector is often driven by traditional management systems and standards such as the ISO 26000 CSR standard (Ranangen & Zobel, 2014). It noted that such standards may promote compliance to CSR but does not necessarily guarantee fair operating practices, community involvement and development which are key sustainability dimensions. The authors recommend the need for a more effective approach to stakeholder management in the mining sector that addresses limitations of the ISO-driven CSR approaches currently promoted by the industry (Ranangen & Zobel, 2014).

From a management perspective, stakeholder analysis can be used as a tool to generate knowledge, insight and understanding about the stakes and interests of stakeholders, their needs and wants, and wishes, demands and expectations amongst others. The resulting insights could be used to inform sound decision making and problem solving about the industry and allow the full benefit from stakeholder management to be achieved.

Following the seminal work of Freeman (1984), stakeholder analysis has attracted significant attention and recognition in the field of management and evolved into a more systematic approach (Elias, Cavana, & Jackson, 2002; Mitchell et al., 1997). Elias et al. (2002) for example, offer a systematic approach of stakeholder analysis that integrates and builds on the work of Freeman (1984) and Mitchell et al. (1997). Their framework, comprising rational, process and transactional-level analytical phases, has been empirically tested and proven useful in various public and private sector contexts. This includes its application to a Lean Six Sigma Project in a public sector organisation in New Zealand (Elias, 2016a). Stakeholder analysis helped the project managers to:

- ❖ Identify stakeholders and their stakes in the lean six sigma project
- ❖ Analyse the effectiveness of the stakeholder management processes of the lean project
- ❖ Evaluate the effectiveness of the transactions between stakeholders and the project, and
- ❖ Capture the changing salience (dynamics) of stakeholders during the project

In another context, a stakeholder analysis was used to inform an analysis of environmental conflict (Elias, 2012). Its nature as a system approach has particular utility in addressing complexity in conflict situations where other traditional approaches may be less useful. (Elias, 2017).

In the specific context of the gold mining industry in Ghana, there have been numerous studies that seek to illuminate stakeholder issues (Alex & Nathan, 2016; Amponsah-Tawiah & Mensah, 2015; Kansake, Kaba, Dumakor-Dupey, & Arthur, 2019; Tuokuu, 2019). However, few studies have offered a formal stakeholder analysis as expounded by Elias, Freeman etc.

McQuilken and Hilson (2016) for example, offered some stakeholder analysis to inform a multi-stakeholder action dialogue on artisanal and small-scale mining in Ghana but did so in a more casual way. The focus of the authors was on government service agencies, civil society, and research institutions. Their approach could be improved by providing specific stakeholders within each of the stakeholder categories mentioned above. The intent was to highlight the important role that stakeholders at the national level play, as change agents.

There seem to be relatively few studies that provide formal stakeholder analysis of the industry to date. Famiyeh (2017), for example sought to provide a formal stakeholder analysis. Following the identification of stakeholders, their stakes and interests, Famiyeh developed a stakeholder power versus interest grid as a sub-set of the rational-level stakeholder analysis proposed by Elias et al. (2002)., However, Famiyeh's approach seems to offer limited understanding about the stakeholder map of the mining industry. Yet, he goes on to generalise his findings about key stakeholders of the industry which can be addressed by this study.

In summary, prior stakeholder analyses of the mining industry in Ghana have been partial or incomplete. There is therefore potential through comprehensive analysis, to inform practice about how to understand and manage stakeholders in the context of the gold mining industry in Ghana.

2.5.2 Previous studies of sequential operations using supply chain analysis

As stated in section 2.2.3, the Ghanaian government has recognised the potential of the mining industry, particularly the gold sector, to act as a springboard to broad-based economic development. Whilst scholars differ in their evaluation of the importance of existing links to and within the mining sector, there is a greater acknowledgement of the potential contribution that an extension of linkages to the wider Ghanaian business sector and to communities hosting mining operations, could make for economic development of the country.

For example, Addy (1997, p. 135) argued that “gold mining sector has only backwards linkages to the rest of the economy; thus any capital injection does not lead to increased intermediate demand for gold”. He suggests the need to shift attention and focus from gold mining to other sectors where there are stronger linkages to the economy. Larsen, Yankson, and Fold (2009) expressed a similar sentiment about the sector when they argued that it must embrace the philosophy of CSR and facilitate development of CSR projects that could benefit mining communities and simultaneously fulfil wider developmental goals in Ghana rather than just rely on linkages. They make this argument based on an implied limited conception they have of the value chain of mining as consisting of exploration, mining and refining activities.

However, Bloch and Owusu (2012) share the view that there are some opportunities for economic development through backwards linkages of the mining industry in Ghana. They argue that the main challenge that confronts the government and the wider mining sector is how to build understanding of such linkages in order to decide how to manage them to maximise the contribution to economic development in Ghana.

Reinforcing this view, the International Study Group Report on Africa's Mineral Regimes has offered a broader conceptualisation of mining linkages that would better serve the sector's contribution to social and economic development. This conceptualisation embraces, in addition to backwards (upstream) linkages that have been forged previously, forward (downstream) linkages, side stream linkages and lateral (migration) linkages (Janneh & Ping, 2011).

They refer to backwards linkages as upstream connections between suppliers and mining companies. In relation to forward linkages, they refer to the downstream links between the mining company and the processors of output from the mine (in this case, gold refineries). Their conceptualisation of side-stream linkages and lateral linkages (new firms) refer to 'seemingly' unrelated economic sectors (other than mining) such as the financial, R&D and skills, infrastructural and telecommunication sectors (Janneh & Ping, 2011).

Janneh and Ping (2011) recommend that African countries, in general, and Ghana, in particular, can, and need to do more in terms of the development of side-stream linkages. However, they suggest that developing the dynamic linkage in the 'beneficiation' chain (i.e., backwards and forward linkages) is critical. They suggest, that backwards and forward linkages offer greater commercial rewards and could in due course result in the development of side-stream and lateral linkages (Janneh & Ping, 2011).

Compared to the narrower conceptualisation of the mining value chain by Larsen et al. (2009), Janneh and Ping's (2011) broader perspective conceives the sector's value chain as comprising exploration, then mining, mineral processing, smelting and refining, semi-fabrication and then final products.

A more extended perspective is by the McKinsey organisation, conceiving the mining value chain as comprising of "everything from extracting raw materials to delivering products to customers" (Görner, Kudar, Mori, Reiter, & Samek, 2020, p. 2). They offer an example of value chain analysis for a business organisation that can be adapted not only by gold mining companies but by the wider mining sector and governments seeking to achieve competitive advantage and create maximum value.

The benefits of supply chain analysis can be enhanced by complementing it with related specific frameworks that can extend its value and utility at the national level, including the Supply Chain Mapping Framework (Lambert & Cooper, 2000; Lambert & Enz, 2017) that emphasise competitive advantage through strategic management of the relationships with key suppliers and customers. They also provide a framework that can for example, be used to model the supply chain

of any given material, parts, components, equipment and services used by the mining industry and identify suppliers with whom the industry needs to manage relationships.

A supply chain analysis also helps to embrace the recommendation of Porter (1990) who emphasises the need to innovate to overcome local disadvantages rather than outsourcing; and to develop domestic suppliers instead of relying on foreign suppliers. Perhaps by embracing the recommended framework of Lambert and Cooper, this study can model the supply chain of specific items linked to the gold mining industry as a platform for understanding issues concerning supply chains of the sector.

2.5.3 Previous analyses using systems methods such as CLD/CLM

Kim (2001) argued that the greatest leverage for effective decision making and problem-solving lies in understanding of the systemic structure of problems. In this respect, Maani and Cavana (2007) point to the importance of CLDs not only in reflecting and representing systemic structure, but also in facilitating systems thinking (ST) in a general sense, arguing that CLDs allow qualitative data to be incorporated into the ST approach, as distinct from related quantitative systems approach, Systems Dynamics (SD).

There have been some attempts at using CLDs to analyse issues concerning the mining industry in Ghana but not limited to gold sector (Amoah, Ahmad, & Antwi, 2004; Antwi- Boasiako, 2003; Armah et al., 2014; Sinding, 2005). However, these studies have mainly applied CLD at a conceptual descriptive level, offering limited guidance on how the industry might benefit from interventions based on a comprehensive CLD identifying points of leverage.

Armah et al. (2014) for example, conceptualised and represented resource use conflict amongst stakeholders of the mining industry and other resource sectors in Ghana, using the CLD approach. Their approach can be improved by embracing insights from systems-thinking approach that reveal the existence of systemic structures known as systems archetypes. Nevertheless, they have highlighted various sources of conflict, and recommended the need to find effective solutions to complex issues affecting stakeholders of the industry by seeking to identify and address their root causes of such conflict (Armah et al., 2014).

Amongst the main sources of conflict, they discuss are: conflict that emanates from the management and distribution of revenues from gold mining; conflict that comes about from illegal (Galamsey) operations; conflict that occurs due to environmental destruction; conflict that arises from compensation and resettlement; and conflict ensuing from concerns about alternative livelihood challenges (Armah et al., 2014).

We note that the use of ‘conflict’ by Armah et al. (2014) in this context reflects the more casual meaning of the term such as struggle or disputes arising from the use and access to mineral resources, and which are quite obvious. They attribute the main causes of such conflict to factors such as a dysfunctional policy environment, lack of clarity in the roles and responsibility of

government agencies linked to the sector, renegotiation of rights, and infringement on the rights of stakeholders, and transitioning from communal to private land title ownership.

Beyond the operational conflicts (disputes) and their causes highlighted above, a more accepted operational concept of conflict is needed that allows us to dive deeper into the root causes of a significant number of issues (problem symptoms) facing the mining industry and resource sectors. Such an understanding could be gained by embracing a TOC approach, reviewed in the section that follows.

In addition, the application of CLD by Armah et al. (2014) could be improved by embracing a systems-thinking approach and in particular, building on awareness of systemic structures labelled as systems archetypes. Being aware of systemic structures and incorporating systems archetypes would facilitate exploration of the mining industry from the lenses of archetypical behaviours attributed to (Senge, 1990). This will enable a more detailed and comprehensive description of the system's problems to inform appropriate actions.

A consistent application of a systems thinking approach that recognises systems archetypes embedded within CLDs is scarce in the context of the mining industry, but is available in other contexts such as demonstrated by Keegan and Nguyen (2011). They used CLD modelling with an intent to “help national leaders and decision makers to see the causal interrelationships between their networks of interconnected socioeconomic, environmental, business and livelihood development responsibilities” (Keegan & Nguyen, 2011, p. 1). Their approach, involving the identification of key variables, behaviour over time charts, causal loop diagramming, identification of system archetypes and leverage points is quite consistent with the causal loop modelling methodology by (Maani & Cavana, 2007).

This approach was able to provide a “deeper understanding of where appropriate intervention strategies can be devised that address root causes as to why Australia’s socioeconomic system is not performing as well as expected” (Keegan & Nguyen, 2011, p. 12).

This study will also benefit by being guided by Causal Loop Modelling (CLM) approach of Maani and Cavana (2007). Such CLM (CLDs together with behaviour over time analysis, and systems archetypes) as demonstrated in Keegan & Nguyen (Keegan & Nguyen, 2011) will allow this study to create a visual representation of the inter-related structure of key problem contexts, problem symptoms and problem causes making explicitly visible the cause-effect relationships between seemingly unrelated variables.

Through understanding and revealing the cause-effect relationships between variables, CLM may lead to insight about significant problems limiting desirable outcomes of the gold mining industry in Ghana and by so doing, highlight key leverage points that could inform practice.

2.5.4 Previous analyses using TOC

The field of TOC has continuously evolved in terms of its methods and broadened its scope and effectiveness, gradually gaining recognition and use in the mining industry and elsewhere, as

outlined below. Two examples of its use in the context of the mining industry (Neamontis, 2015; Ngcanga, 2020) will then be reviewed to understand what has been covered already, and where opportunities exist for this study to contribute and advance the field.

In the early days of TOC, it was emphasised that the ultimate goal of organisations is to make money (Friedman, 2007; Goldratt, 1992). If so, the gold mining industry must be able to achieve its business goals in the making of money in order to survive and create value for key stakeholders. It is therefore critical for the industry to be able to understand and manage constraints that limit desirable outcomes for stakeholders of the industry including mining companies.

TOC is designed to provide organisations with frameworks and tools necessary for understanding and making sound decisions and addressing complex problems as well as to guide the execution of needed changes towards the business goal.

Since its early roots in manufacturing, (Goldratt, 1984) TOC has been further developed and expounded in various books, presentations and videos by Goldratt (see list in Cox and Schleier, 2010, pp1137-1144), as well as by many other practitioners and scholars, evolving into what is now viewed as a systems methodology for effective management of change and improvement in any system (Cox & Schleier, 2010; Davies et al., 2005; Dettmer, 2007).

The focus on making money has been broadened too as the scope of TOC has embraced social systems and expanded its methods used to include thinking processes (TPs) for managing change.

The broader conception of TOC has been expressed as:

“...TOC as an espoused methodology seeks to assist with the ‘management of beneficial change’ in organisations by using logic-based modelling and analytical tools in the belief that organisations as systems can be subject to continuous improvement aiding to long term survival – if those barriers, obstacles and other factors constraining or limiting improvement can be identified, and removed or managed effectively” (Davies et al., 2005, p. 508)

TOC is underpinned by a philosophy of continuous improvement, not just improving problematic situations, but in the development of the tools and methods that comprise the wider TOC methodology. Indeed, TOC scholars and practitioners openly recognise and seek to remedy weaknesses in the TOC approach. This is demonstrated (Schrage, Dettmer, & Patterson, 2009, p. ix):

“There’s a lot of emotional pains in realizing that for years we’ve done things in a flawed or incomplete way...Throughout the 1980s and most of the 1990s, Theory of Constraints (TOC) focused on the optimisation of an internal constraint.”

TOC’s approach is encapsulated in three processes of ongoing improvement (POOGI), including the ‘Five “Focusing Steps” (5FS), Thinking Processes (TP) and Buffer Management (TOCICO Dictionary, 2012). One of the strengths of TOC which has enabled continuing critique is the set of

logic protocols on which it is built. (See Dettmer (2007) Chapter 3 and particularly the categories of legitimate reservations (CLRs) (Mabin, Forgeson, & Green, 2001).

2.5.4.1 TOC's processes of ongoing improvement (POOGI)

The TOC processes of ongoing improvement (POOGI) began with the “Five Focusing Steps” (5FS) approach, aimed at manufacturing and other physical processes. It expanded to include the Thinking process tools (Goldratt, 1990, 1994). This was based initially on three key questions for managing change namely: *what to change*, *what to change to*, and *how to cause the change* (Goldratt, 1990).

Further improvements in the field saw the addition of two fundamental questions to the above, addressing why change, and the how to sustain and measure the change, (TOCICO Dictionary, 2012) and resulting in the “change question sequence (CQS) framework.

Consequently, the TOC POOGI has evolved to comprise the 5FS and the CQS and buffer management approaches. The 5FS framework focuses on managing bottlenecks and physical constraints, while the CQS are suited to the more complex, policy constraints, using the TOC thinking process (TP) (Dettmer, 1997; Goldratt, 1994). The TOC approach and the concept of the 5Fs and CQS are revisited in Chapter 3 for further review and details.

Before his demise in 2011, Goldratt continued to add and expand on the relevance of the field. For example, in his introduction to the “Science of management”, Goldratt referred to management attention²² (MA) outlining the three core duties that must be the focus of managers, including managing complexity, uncertainty and conflict (Goldratt Consulting, 2017). According to Goldratt, losing focus on these core managerial duties is a waste of management attention and constitutes a fundamental constraint.

2.5.4.2 Use of TOC at MMG Limited

Neamontis (2015) provides some examples of mining companies where TOC is well-recognised and embraced, including the Minerals and Metals Group (MMG) Limited. MMG is a worldwide mining company that explores, develops and mines base metal deposits and operates in Australia, South America, Asia, and Africa. MMG uses TOC in an integrated fashion, complementing it with the company’s traditional Asset Utilisation (AU) framework into a unified model to guide the management and operations of this worldwide company (Neamontis, 2015).

This suggests the versatility and hence, the possibility for TOC to be adapted for use with existing approaches in the mining industry without necessarily undergoing a complete abandonment of existing approaches. In such situations, the important thing to do will be to find a balance of fit between TOC and the traditional system-in-use.

²² Management attention (MA) is used here to mean managerial resource of an organisation.

At MMG for example, Neamontis (2015) implies that TOC was used to identify areas where the significant production losses occurred within the system, using TOC's Five Focusing Step (5FS) approach expounded in Goldratt (1992). This was followed by the application of AU (Asset Utilisation software) to quantify the value of such losses. Relevant other tools were then applied to manage needed changes and continue improvement. However, evidence of the use of the TP tools by MMG is not provided.

2.5.4.3 Use of TOC (5FS) at Moolmans

At a virtual conference of the Theory of Constraints International Certification Organisation (TOCICO 2020), Ngcangca (2020) provided a comprehensive presentation on how Moolmans (a contract mining company with operations in Guinea, Africa) significantly benefited from the re-treading of used Tyres, using the 5FS. Adopting the 5FS approach allowed the Moolmans Company to focus on the system's goal adopting a single metric for the entire system ('maximising throughput') as explained by Ngcangca (Ngcangca, 2020). This necessarily required the Moolmans Company to identify the system's constraint (in this case, Tyres), train teams in the application of TOC, and ensure that all staff (from management to operators) focused on Tyres as the system's constraint.

According to Ngcangca (2020), applying the TOC's 5FS at Moolmans resulted in some impressive cost savings in relation to Tyres as follows:

- ❖ Cost saved after repair of 35 tyres & scrapped (USD58,066.13)
- ❖ Cost saved after repair of extra 13 Tyres in-use (USD38,679.88)
- ❖ Savings due to prolonged life of 7 tyres repaired (USD 82,836.00)

This brings total savings from repaired tyres to USD 179,582.00 which is equivalent to the amount that Moolmans would have spent on purchasing 14 tyres of the same specification as those repaired as Ngcangca (2020) seems to suggest.

Whilst the above examples emphasise cost-savings, TOC is ultimately about helping organisations to make more money. It is however, understandable the overall intent of applying TOC at Moolmans was to improve throughput performance (Ngcangca, 2020) of which cost-savings can be made possible.

2.5.4.4 The potential for Ghana's gold industry to benefit from TOC

The issue of used tyres (i.e., re-treading of worn-out tyres) seems to constitute an integral component of the list of items legislated for local procurement list (see Table 6.1) as well, suggesting the potential to benefit from a TOC approach. The cost-saving potential of TOC described above would apply to mining companies in Ghana too, not only Moolmans in Guinea.

Although there is no evidence of use of TOC, the gold mining industry in Ghana has demonstrated recognition for recycling and the need to ensure the effective management of wastes (Ghana

Chamber of Mines, 2019). One of the main considerations relates to the need to find possible alternatives for the disposal of used Tyres as captured below:

“The Committee also considers the alternative use of old tyres by member companies that could offer better value for communities. Evidence on the alternative use of such Tyres showed that old Tyres were used for commercial activities including design of furniture, dustbins, bags, and pavements. The committee therefore explored different modalities to make these old Tyres were legally available to entrepreneurs who wish to use them in ways that do not harm the environment” Source: the 2019 Annual report Ghana Chamber of Mines.

Perhaps, the TOC approach may offer some more benefits to the gold mining industry in relation to the issue of extending the use as well as the recycling of old tyres highlighted above. There is also room for the industry to benefit from the TOC concept of buffer management and associated concepts for enhancing flow, including the concept of make to availability (MTA), described as a special case of make to stock (MTS) (Schrageheim et al., 2009). These authors note that there is the potential for organisations using the more traditional concept of make to order (MTO) to complement this with the MTA for enhanced benefits.

Indeed, from the researcher’s experience, the gold mining industry in Ghana already uses the MTO and MTS. An aspect of the MTS system in-use by the industry is vendor managed inventory (VMI) which mimics characteristics of the MTA (Schrageheim et al., 2009). However, there is opportunity for the industry to benefit from embracing the right TOC tools and techniques such as the Drum Buffer Rope on which the flow strategies described above are premised (Schrageheim et al., 2009).

The TOC tools and techniques will be considered later in order to decide the details that may be more relevant for the purpose of this study.

2.5.5 Previous studies reflecting Multi-Framing

“If I can see a little further, it is by standing on the shoulders of the giants” (Sir Isaac Newtown)

It is generally recognised that effectively managing complexity requires the ability to use multiple frameworks, models or tools to generate a range of perspectives that provide a more rounded understanding of the problem context, even if these perspectives are underpinned by different or even competing paradigms or theories (Jackson, 1999; Mingers & Gill, 1997; Quinn, 1988).

There have been numerous approaches propounded by various authors for better understanding and solution of problems and facilitate effective decision making (Bolman & Deal, 2017; Jackson, 1999; Mabin & Davies, 2004; Mingers & Gill, 1997; Munro & Mingers, 2002; Russo & Schoemaker, 1991) – including multimethodology and multi-framing amongst others.

Multi-methodology has been beset by arguments about incommensurability including (Jackson, 2003; Mingers & Brocklesby, 1997). In this context, incommensurability describes an implied belief in the superiority of one paradigm, theory method or framework over another, thereby

creating a gap or blurring the potential for a harmonious relationship amongst alternatives when trying to combine methods from different paradigms. The issue of incommensurability places a fundamental limitation on a multi-methodological approach to dealing with real-world problems as long as the proponents of the approach maintain the incommensurability thesis (Hassard, 1988; Weaver & Gioia, 1994).

In this regard, researchers, including Mingers (1997) call attention to the feasibility of cross paradigm research and the need for a practical way to promote the field as illustrated below.

“Although the paradigm incommensurability issue has to be taken seriously in debates about methodology, there are grounds for believing that cross paradigm research is philosophically feasible. What is required is an underpinning philosophical framework that can encompass the different paradigms, and guidance on appropriate ways to mix different research methods.” (Mingers, 1997, p. 14)

Consistent with the above views, Eden et al. (2009) also suggest that the issue incommensurability could be avoided by seeking practical solutions to the long-standing theoretical conceptions as according them, such issues stymie progress/development of the multi-methodology approach.

Russo and Schoemaker (1991) promote the use of metaphor to enable framing and reframing (multi-framing) of issues arguing that there is no frame of best fit. Similarly, Bolman and Deal (2017) and others such as Tallant and Strachan (1995) from other functional domains and disciplines, also recognise and encourage the use of multi-framing. For instance, Bolman and Deal suggests that we must use metaphors to frame and reframe about leadership issues facing organisations for better understanding leading to appropriate solution.

However other authors propose multi-framing that does not necessarily use metaphors. For example, in the context of decision making and problem solving, scholars have demonstrated that frames could be drawn from ‘seemingly’ disparate yet complementary fields and domains such as management and social sciences, soft and hard OR/MS methods and applied in a multi-framing fashion (Davies & Mabin, 2001; Davies & Mabin, 2001b). Thus Mabin and Davies (2004) suggest the use of multi-framing²³ when faced with complexity.

Considering the complex characteristic facing the gold mining industry in Ghana, this study may benefit from being guided by multi-framing following the recommendation of Davies and Mabin (2001b). Thus by embracing the authors’ recommendations this study can provide voice for stakeholders of the gold industry in Ghana to share their views about the sector and allow for further analysis, using suitable frames that are suitable for analysing the issues surfaced. This way a multi-perspective, multi-framing exploration of the industry would be achieved to enhance to

²³ Multi-framing is the process of acquiring better managerial knowledge about human experience using multiple complementary lenses to generate multiple perspectives for a better understanding leading to effective action (Bolman & Deal, 1991; Mabin & Davies, 2004; Tengblad, 2012)

impact on better understanding, knowledge and insight that can be shared with the stakeholders of the industry to ultimately impact on outcomes for stakeholders.

Hence, the next section considers what has been done by prior multi-framing studies in the context of gold mining in Ghana to provide a firm basis for this study to contribute and advance. As reviewed above the multi-framing approach of interest (for the purpose of this study emphasise the use of tools, frameworks and methods in a complementary manner that leads to actionable knowledge and insight to improve practice.

Put in context, multi-framing in this study means each different analytical frames, tools or methods to be used in this study is situated within its own paradigm, using its own protocols – not attempting integration or combination – thus avoiding the issue of incommensurability.

Next, contextual studies are examined for evidence of multi-framing

2.5.5.1 Multi-framing in the context of mining industry in Ghana?

The literature search could find no studies that seek to offer a multi-framing analysis of the broader context of the mining industry in Ghana. However, there are researchers who share a similar notion and motivation to that of this study to provide a platform for better understanding, leading to sound decision making about the mining industry in Ghana that could be considered as multi-framing.

For example, Kusi-Sarpong, Sarkis, and Wang (2016a) are amongst the most prolific authors offering insights regarding greening of supply chains in the context of the gold mining industry in Ghana.

They emphasise and advocate green supply chain management practices and have developed a comprehensive framework for evaluating such practices in the mining industry that require organisations to assess their performance based on six key dimensions of green practices spanning the sector's supply chain.

These key dimensions of green supply chain management practices relate to: green information technology systems, strategic supplier partnerships, logistics and operations integration, internal environmental management, eco-innovation practices, and end-of-life practices (Kusi-Sarpong, Bai, Sarkis, & Wang, 2015, p. 96). They imply that by measuring performance against key factors they identified under the key dimensions of green practice highlighted above, the mining industry would successfully ameliorate its environmental problems throughout the entire supply chain of the industry.

Kusi-Sarpong et al. (2015) not only encourage the use of multiple criteria approaches (implying multiple goals) but demonstrate the practicality of integrating 'rough set and fuzzy TOPSIS (approaches as a methodology for evaluating programs based on green supply chain management practices. Subsequently, they have also demonstrated the integration of the Decision-Making Trial and Evaluation Laboratory (DEMATEL) methodology and the Analytical Network Process approach to evaluate green supply chain practices in the gold mining industry in Ghana (Kusi-Sarpong et al., 2016a; Kusi-Sarpong, Sarkis, & Wang, 2016b).

They have additionally employed what they referred to as ‘Supply chain sustainability innovation framework and evaluation methodology that utilises the ‘best-worst’ approach as a criterion to rank supply chain innovation and sustainability in other contexts (Kusi-Sarpong, Gupta, & Sarkis, 2019). Indeed, greening of the mining supply chain could enhance the contribution of gold mining by helping to minimise adverse environmental and social consequences as Kusi-Sarpong et al. (2016a) implied. However, they do not appear to have used these tools in a multi-framing sense.

In another example, Basu, Renne, and Long (2015) recognised the complex nature of issues facing the mining industry, particularly the ASSGM sector, and sought to ultimately inform sound decision making about the sector. They brought people from different disciplines to interpret and reach consensus on the solution to key ‘problems or challenges or concerns in an approach that paralleled Eden et al. (2009) who brought three pair of academics from different academic disciplines and theoretical backgrounds together to try to establish consensus on an inclusive, analytic and quick solution to a practical problem.

In the case of Basu et al. (2015), the study team comprised work groups from three disciplines namely: the Natural Sciences, Human Health, Social Science and Economics, in addition to other experts. These studies differ in that whilst one is based in the domain of OR/MS with grounding in multi-methodology (Eden et al., 2009), the other can be viewed as being multi-disciplinary research based on an integrated assessment framework. While such research shares a similar interest and motivation with this study, they do not reflect a multi-framing framing approach.

2.5.6 Key limitations of previous analyses of mining industry

There is a paucity of studies that offer a comprehensive and systems-based analysis of the mining industry of the nature suggested in this study. No evidence has been found of systems-based studies for dealing with aspects of characteristics exhibited by the mining industry in Ghana as illustrated in Table 2.1. As indicated in the said table, some of the tools, frameworks and methods that are considered suitable to deal with the complex characteristics of the industry more effectively may include stakeholder analysis (SA), supply chain analysis (SCA), and causal loop modelling (CLM) approaches, or the application of the Theory of Constraints (TOC) management thinking process (TP) tools.

With respect to stakeholders, a systematic stakeholder analysis exists in other contexts (Elias, 2016b). However, thorough applications of stakeholder analysis in the context of the mining industry appear to be lacking.

In the specific context of Ghana, Famiyeh (2017) sought to address the stakeholder analysis gap but was faced with a fundamental limitation in his methodology (see section 2.5.1). With respect to supply chains, while Bloch and Owusu (2012) recognised opportunities for economic development through backwards linkages and called for studies to help the industry understand such opportunities, others express a contrary view, arguing that attention should be shifted from a focus on linkages to CSR solutions (Larsen et al., 2009).

Indeed, Kusi-Sarpong et al. (2015) contribute to knowledge about green supply chain which is necessary but not sufficient for addressing the need. As a consequence, lack of better understanding to exploit opportunities in the gold supply chain remains a fundamental challenge. Thus existing knowledge about supply chains differs all together from what is currently required (Bloch & Owusu, 2012).

As such, clarifying the notion of a supply chain to enhance knowledge and understanding and hence, facilitate the ability to more clearly, see opportunities within the gold mining supply chain is critical for addressing the existing gap. However, none of these studies seems to have offered adequate guidance for understanding the fundamental issues facing the industry from a supply chain perspective.

With regard to systems thinking, studies such as Armah et al. (2014) sought to demonstrate the application of CLD but lacked a rigorous basis in systems thinking. A systems thinking study may be characterised or involve one or more of the following: problem structuring; causal loop modelling; dynamic modelling; scenario planning and modelling; and implementation and organisational learning (learning lab) (Maani & Cavana, 2007, p. 198).

As reviewed in section 2.5.3, the above characteristics were not present in studies that sought to demonstrate the application and utility of CLD in the context of mining industry in Ghana. Although a typical example is found elsewhere that is valuable (Keegan & Nguyen, 2011), the context, based on rural development and food security in Australia, is entirely different. Thus we may need to adapt it to be better suited to the specific context of the mining industry (in Ghana).

Considering the application of TOC, there is a surprising absence of relevant TOC studies in the context of the mining industry in Ghana. The researcher notes that Appiah, Possumah, Ahmat, and Sanusi (2018) sought to use TOC to analyse SME investment decisions in Ghana. However, they did not provide any evidence of how TOC was used to reach their findings.

Indeed, there is some evidence of the application of TOC within the mining industry as reviewed under sections 2.5.4.1 & 2.5.4.2. However, such work was limited to the use of 5FS framework with no evidence for the application of the TOC-thinking process (TP) tools.

2.6 Summary of the research gap

“If the only tool you have is a hammer, you tend to treat everything as a nail” (Abraham Maslow, 1908-1970, American Psychologist)

In summary, there is limited evidence of the use of systems-related analysis of the (gold) mining industry in Ghana, and a similar lack of published evidence and concrete examples of the application of stakeholder frames and analysis, supply chain frames and analysis, causal loop modelling - mirroring a surprising lack of application of TOC.

The research gap then not only relates to the mining sector knowledge base but is also methodological. It reflects multiple shortcomings associated with single-lens or single-frame approaches and suggests potential benefit from a multi-framing approach.

To avoid the ‘hammer and nail’ pitfall highlighted above, this study will address the research gap using multi-framing incorporating stakeholder analysis (ST), supply chain analysis (SCA), Causal loop modelling, and TOC and its associated thinking processes (TP).

This will help to improve understanding about the: systemic structure, the systems dynamics, and root causes of systemic problems /within the gold mining industry in Ghana. The resulting insights would help inform the development of a framework appropriate to facilitating a strategic response to dynamic problems of the industry.

2.7 Multi-framing research gap and conceptual framework

Bolman and Deal (1991) have engaged in multi-framing across multiple sectors to understand leaders’ implicit and explicit use of frames in their everyday management activities, and then how such leaders are perceived by their co-workers. Their approach, initially developed in the 1980s has undergone revision and evolved over the years (Bolman & Deal, 2017).

In the complex world of military operations, multi-framing approach is also recognised and applied. It is considered as an approach better suited for decision making and problem solving in the military sector than would be unitary-based approaches (Zweibelson, Martin, & Paparone, 2013). In the context of higher education, multi-framing is also recognised and embraced as conceptual framework for guiding thesis/scholarly studies, including for example at the doctoral level thesis (Thompson, 2000).

Many previous conceptions and related uses of multi-framing have tended to follow, sometimes in limited fashion, the metaphorical frames used by (Bolman & Deal, 1991). Perhaps recognising this pattern of use, and to better reflect their intentions, Bolman & Deal (2017) now refer to their approach more appropriately as ‘reframing’.

In related fashion, Mabin and Davies (2004) approach to multi-framing, has demonstrated the practicality of combining multiple frames drawn from complementary systems thinking tools such as causal loop diagramming (CLD), theory of constraints thinking processes and other soft and hard OR methods. Other studies using multi-framing have explored issues of methodological development in theory of constraints (TOC) management (Cox, Mabin, & Davies, 2005), have explored how to complement CLD with TOC to effectively solve practical problems (Mabin, Davies, & Cox, 2006), and have applied multiple lenses of TOC, CLD and stakeholder analysis to sustainable water management issues in a New Zealand urban community (Moore & Mabin, 2014).

In summary, we note that multi-framing is conceived differently by different authors in the field. Since this study seeks to apply multi-framing using a variety of complementary systems ST thinking tools in a mix-and-match manner, the approach of (Davies & Mabin, 2001b), employing multi-framing as a guiding framework, has been selected for the quest of gaining a better

understanding of, and providing a platform for better decision making about gold mining sector to ultimately impact on outcomes for stakeholders.

As indicated above, using those authors' approach allows this study to take into consideration the role of context and demonstrate the use of frames in a complementary fashion (situating each frame in its own paradigm and protocols) rather than seeking to integrate or reconcile their difference.

As such, this thesis contributes to advancing the field by seeking to approach multi-framing both sequentially and iteratively, working down through layers of various systemic levels of an industry – in this case the gold mining industry in Ghana. Figure 2.1 provides a visual description of the recommended methods that will be used in the multi-framing to suit the context of the gold mining industry in Ghana, and a rationale for the approach used in this study.

Details of each of these methods are provided later in appropriate section under the methodology chapter. These include stakeholder analysis (SA), supply chain analysis (SCA), causal loop modelling (CLM), evaporating cloud (EC), current reality tree (CRT), goal tree (GT), future reality tree (FRT), prerequisite tree (PRT), five focusing steps (5FS), and change question sequence (CQS).

Figure 2.1: Methods to be used in the multi-framing context of this study

2.8 Research purpose questions/objectives

The purpose of this study is to adopt multi-level, multi-framing perspectives to develop an understanding of the nature, structure and relationships that make up the gold mining industry in Ghana. This will be done with a view to providing government, political and mining sector policy decision makers, and other interested actors with a platform for understanding the sector in order to support their decision making about the industry and potentially improve outcomes for key stakeholders.

The study intends to address identified research gaps by achieving the research objectives as follows:

1. Develop a comprehensive, multi-perspective description and understanding of the nature, structure and relationships that make up the gold mining industry in Ghana.
2. Identify root causes of significant problems facing the gold mining industry in Ghana and offer suggestions for possible alternatives that when implemented could help to overcome such problems.
3. Demonstrate the utility of complementary multiple systems thinking frameworks that can in due course provide government, political and mining sector policy decision makers with a better understanding of the sector in order to support their decision making not only strategically but also operationally and tactically, where necessary.

Specifically, the research set out to meet the above objectives via the following research questions.

- ❖ What is the nature, structure, and relationships that make up the gold mining industry in Ghana?
- ❖ How can decision makers logically analyse (identify and understand), and address significant problems limiting desirable outcomes for the industry?
- ❖ What is the utility of a multi-framing approach in providing a platform for decision making and problem solving about the industry?

2.9 Chapter Summary

This chapter has reviewed literature specific to the gold mining industry in Ghana and covered relevant methodological and conceptual frameworks for understanding the characteristics and complexity exhibited by the sector. Key limitations of prior analyses of the mining industry in Ghana are identified; and 1 opportunities to contribute to knowledge of the sector through multi-framing OR/MS highlighted whilst specifying whilst setting the boundaries of its application and the range of specific methods that would be used in the framing process.

It could be noted that whilst multi-framing and multi-methodology come from the same root in OR/MS field and parallel each other, the two are distinct in terms of their fundamental beliefs how to bridge the gap between seemingly disparate methods, tools, frameworks, theories and philosophies in practice. Thus multi-methodology emphasises an all-encompassing framework to guide the field (Jackson, 1999, 2001; Mingers, 1997, 2001) reflecting a belief and hence, emphasis

on a one size fits all approach to mixing methods. On the other hand, multi-framing recognises the need to harness the strengths of different frameworks to complement weaknesses or oversights of another frame by using the frames in a structured manner as much as it builds on complementary strengths or overlaps (*Davies & Mabin, 2001a, pp. 63-64*).

Multi-framing can therefore be considered a “no-one-size fits all” approach. It recognises the tendency to approach for example, technical problems with frameworks that are better suited for technical analysis, and complex problems with frameworks that facilitate analysis of complexity. Multi-framing thus, suggests that we should/can avoid this tendency by framing from one perspective and reframing from another’s perspective as illustrated in (*Davies & Mabin, 2001b; Mabin & Davies, 2003*). Multi-framing from an OR/MS perspective is also distinct from traditional approaches in that the latter’s perspective from the domain of leadership practice, mainly focuses on metaphors.

Beyond metaphors, multi-framing in the context of OR/MS is opened to using a wide range of problem structuring methods, the choice of which is largely determined by the problem context or situation at hand.

In conclusion, the chapter has also highlighted prescribed methods that are intended to be used in the multi-framing approach of this study, followed by statement of the research purpose, objectives, and questions.

The next Chapter considers relevant aspects of the research methodology.

Chapter 3 : Methodology

If I can see a little further, it is by standing on the shoulders of giants – Sir Isaac Newton

3.1 Introduction

The previous chapter identified research gaps and outlined research questions and objectives that need to be addressed to contribute empirical knowledge of gold mining industry in Ghana. It discussed using a multi-framing approach in order to understand what needs to change, what to change to and how to cause the change. This would provide government, political and mining sector policy decision makers, and other interested actors, with a platform for understanding the sector in order to support their decision making about the industry and potentially improve outcomes for key stakeholders.

This chapter describes how the study was operationalised and analysed using the multi-framing approach. Specifically, it identifies and outlines the research paradigm that underpinned the study and reviews relevant aspects of the research design. It also covers challenges during field study and how they were managed. Finally, the chapter reviews literature pertaining to relevant aspects of the multi-framing analytical framework and concludes with a chapter summary.

3.2 Research paradigm: critical realism

This study uses a critical realism paradigm. Critical realism is based on the belief that reality exists beyond mere observation, and can be defined by entities and the cause-effect relationships between them (Bhaskar, 2009; Fleetwood, 2005). As Dobson (1999, p. 268) puts it, a critical realist's approach "recognises the subjective nature of knowledge and argues for the presence of underlying deep mechanisms and enduring structures within the social world."

This study's approach parallels or resonates with critical realism in that it invokes logic protocols to challenge assumptions about the existence of entities and cause-effect relationships among others, and to validate their inclusion in the models developed using the multi-framing approach. Critical realism also places emphasis on the need to promote synthesis of multiple perspectives even if these are in opposition (Bhaskar, 2009).

The same notion also underpins each of the various systems thinking (ST) frameworks and methods employed in the multi-framing approach of this study, particularly those drawn from the domain of TOC (Goldratt, 1990). Within the domain of OR and ST, critical realism is recognised with importance. For instance, Mingers (2004) recommends the use of critical realism as the philosophical underpinning of systems-based studies, arguing this helps business schools, and hence managers and practitioners, to engage with practical problems (Mingers, 2015).

Given the complexity and system-wide effects and other characteristics of the gold mining industry in Ghana as highlighted from the previous section, a critical realist's paradigm is an appropriate underpinning for this study. The ontological and epistemological underpinning of a number of systems methods have already been well explored (Davies et al., 2005; Mingers & Brocklesby,

1997). These systems methods facilitate problem structuring, and while they do not challenge power structures directly, TOC in particular is instrumental for critiquing from the outset, taken-for-granted assumptions and power relations that contribute to core problems (Davies et al., 2005).

3.3 A qualitative, exploratory study based on the abductive research approach

This study is qualitative and exploratory in nature. Whilst qualitative research can be approached as case study, phenomenological, grounded theory, or ethnographic research (Creswell, 2014), a case study approach is often recommended in business and management research (Eisenhardt & Graebner, 2007).

Case study research allows us to acquire deeper knowledge about phenomena in their natural contexts, and is appropriate for addressing the “how” and “what” types of questions (Yin, 2013). Also, Dubois and Gadde (2002) imply the need for an abductive research approach when studying complex sectors, including the mining and construction industries. In the abductive research approach, the research process involves iterating/going back and forth between theoretical and practical insights, bridging the subjective-objective divide (Dubois & Gadde, 2002; Kakkuri-Knuuttila, Lukka, & Kuorikoski, 2008). All such notions apply to this study, making the abductive approach and case study combination appropriate.

The abductive nature of this study is such that, it starts by exploring the literature for theoretical insights then using these to develop models for feedback from participants for better understanding leading to refinement of the models. It also involves iterating back and forth between models and evolving understanding about the problem context to develop actionable solutions. Also, the abductive research approach is well suited to the case study research design in that it can facilitate a fundamental purpose for the case study research.

Drawing from Stake (1995), case study research may serve either an instrumental purpose to aid understanding of the world, or an intrinsic purpose especially if the focus is on the case itself. In addition, critical realism²⁴ is considered ‘well suited as companion’ to case study research (Easton, 2010). Critical realism combines both agency and structure, as well as helps the researcher to be context-specific and recognises reality that is situation dependent (Dobson, 1999).

From a critical realism stance, this study uses case study as an instrument for acquiring knowledge and understanding of complexity of the case under study, namely the gold mining industry in Ghana, specifically the cause-effect relationships underlying key issues limiting desirable outcomes for stakeholders of the sector relative to the expectations of key stakeholders (including the state, communities, and mining companies).

²⁴ “Critical realism is particularly well suited as a companion to case research. It justifies the study of any situation, regardless of the numbers of research units involved, but only if the process involves thoughtful in-depth research with the objective of understanding why things are as they are” (Easton, 2010, p. 119)

The abductive research approach facilitates better understanding of the situation by allowing the study to evoke the subjective voices and viewpoints of stakeholders of the study context for more informed conclusions and recommendations.

3.3.1 Single case study with embedded units of analysis

Good practice in case study research requires the specification of the case study boundary or unit(s) of analysis when using a case study approach (Baxter & Jack, 2008). It is additionally critical that we specify the sample design and sampling process (Bryman & Bell, 2015). To address these matters, this study draws from Yin's (2013) case study categorisation and protocol, namely: single case with single unit of analysis; single case with multiple units of analysis; multiple cases with single unit of analysis; and multiple cases with multiple units of analysis.

The approach adopted in this study is the single case with multiple units of analysis. Specifically, the study uses the gold mining industry in Ghana as a single case comprising multiple units of analysis at national, industry and community levels as shown in Figure 3.1 below. It then identifies for analysis, undesirable effect(s) (UDE²⁵) that limit desirable outcomes expected from the industry and that concern the wide range of stakeholders of the sector, including state, communities and companies, which affect and are affected by decisions, and actions (inactions) within the industry.

Figure 3.1: Single case with multiple units of analysis

²⁵ Undesirable Effect (UDE) – an adverse outcome on (in this case, on stakeholders of the gold mining industry in Ghana) that might be the result of actions (inactions) or decisions made about the industry.

3.4 Sampling design and case selection

Patton (1990) asserts that the quality and credibility of a qualitative study can be enhanced by using purposive sampling although findings may not be generalised. It is also noted that in purposive sampling, samples are selected depending on their relevance to the research question or purpose, the researcher's knowledge and experience of the research area, and evidence from relevant literature (Marshall, 1996).

A typology of purposive sampling approaches is offered by Teddlie and Yu (2007) which categorises sampling techniques based on the purpose they serve, for example, to achieve representativeness, or to reflect the uniqueness of cases or the sequence of events. They also argue for combining such sampling techniques where necessary, especially in studies involving multiple levels of analysis.

This study approaches sampling using combination of purposive sampling techniques. Given the important role that stakeholders can play in determining the future of any organization (Eden & Ackermann, 2013; Elias et al., 2002), they cannot be taken for granted, especially in a study like this which may lead to conclusions and recommendations that may have impact on the daily lives and activities of such stakeholders. Additionally, the multi-framing approach of this study also emphasises the need to recognise the role of the study context, and promotes the deliberate change of frames by considering other possible interpretations of a problems (Davies & Mabin, 2001b).

In view of the above, the study recognised the need to provide a voice to stakeholders at the national, industry and community levels to share their views on topical issues identified from an initial literature review of the mining industry as limiting desirable outcomes for stakeholders of the sector. Thus, sampling was approached purposively as illustrated in Table 3.1 and further elaborated below.

As Patton (1990) suggests, broad generalisation is not the intention of a case study. Facts are presented, leaving generalisations or otherwise to be decided by interested stakeholders based on their perceptions and judgements. The sample design in Table 2 below indicates the intended ideal maximum number of 29 discussions, 5 from the national level, 19 from the industry level (LSGM Companies = 10; Formal small-scale mining = 2; 'Galamsey' = 5; LGBs = 2), and 5 from the community level.

However, if time constraints or other unforeseen circumstances were to arise or saturation reached, a lower limit of 20 discussions was judged to be satisfactory for the purpose of this study, made up of: 4 at national level, 13 at industry level (LSGM companies = 6; Formal small-scale mining = 2; 'Galamsey' = 3; LGBs = 2), and 3 at the community level.

Table 3.1: Sample design

Level		Entity	Data Collection		Maximum Number of Participants Meetings	Minimum Number of Participant Meetings
National	Governing bodies	Minerals Commission	Presentation + Feedback/Follow-up discussions	Senior Officers with over 5 years of experience	1	4
		Environmental Protection Agency			1	
		Precious Minerals Marketing Corporation			1	
		Geological Survey Department			1	
		Ghana Chamber of Mines			1	
Industry	Large Scale	LSGM company 1	Presentation + Feedback/Follow-up discussions	Operations/ mining Manager and Supply Chain Manager	2	6
		LSGM company 2			2	
		LSGM company 3			2	
		LSGM company 4			2	
		LSGM company 5			2	
	Small Scale	Formal Small-scale Mining Firm (Typical case/representative sampling)	Presentation + Feedback/Follow-up discussions	CEO/General Manager and Operations/ Supply Chain Manager	2	2
		Local Ghanaian Mining Supplier (Typical case/representative sampling)	Presentation + Feedback/Follow-up discussions	CEO/General Manager/ Marketing Manager	2	2
		Informal Small-scale Operators (Galamsey)	Focus Group discussions	'Galamseyers' (Residing in mining/catchment communities)	3/5	3/3
Community Level		Indigenous Mining Communities and Catchment Areas	Presentation + Feedback/Follow-up discussions	District/ Municipal Chief Executive (DCE/MCE) Officers	5	3

- **National Level**

Entities at the national level were selected based on their direct involvement and relevance to the gold mining industry in Ghana. Participants were heads of relevant units or departments within their respective organisations. At this level, the main focus was to gain regulatory insight about the management and analysis of the impact of gold mining in Ghana.

It was planned those participants would be senior officers with over 5 years of mining industry related experience and willing to participate, or a representative of a senior officer who meets the main focus was to understand the management of impact and hence, covers a number of aspects relevant for gaining regulatory insights about the environment, social/economic (fiscal) and issues across the gold mining supply chain.

- **Industry Level**

LSGM sector was the main focus at this level. As such, entities were to be selected based on level A membership of the Ghana Chamber of Mines²⁶ (GCoM) which classifies its members into represented, pre-production, contract mining, exploration, and affiliate categories. Five (5) entities out of eight (8) within this category were targeted for the study, representing 62.5% of the total population of firms associated with gold mining.

Operational issues relating to the mining supply chain was the main interest at this level. Hence, the operations and supply chain managers and mining managers were of interest because of their knowledge and direct involvement in supply chain activities. However, this did not go according to plan for reasons that are outlined later (section 3.5.1).

With the formal small-scale gold mining sub-sector, senior managers, defined as either the CEO/general manager, or the operations/supply chain manager of leading small-scale gold mining firms, were the main target. Surprisingly, formal small-scale mining setups are rare and hence, such participants were hard to find. Without the help of key personnel at the EPA, it would have been impossible to get hold of such participants. Those interviewed were owners of small-scale mining concessions. Hence, they could be considered as CEOs, but the two participants interviewed also serve as chiefs in their respective mining communities. As such they may overlap with DCEs/MCEs – the last category in Table 3.1 above.

Informal small-scale mines are often operated by ‘Galamseymen’²⁷. These ‘Galamseymen’ often include community members, living in and known by the community. Therefore, it was possible to identify them using some close contacts, to represent the informal small-scale gold mining sub-sector.

Regarding local Ghanaian businesses, at least 1 leading local-based supplier to the mining industry (Ghanaian owned firm) was to be chosen, represented by the CEO if possible, or the general manager/marketing manager. That company was to be identified by at least 3 out of the 5 large-scale gold mining entities involved in this study as a major supplier to their operations. However, this did not go as planned, as most of the data collection took place at/after conferences (see section 3.5.3.4).

- **Community Level**

At the community level, it was considered that appropriate representation will be provided by officials of the District/Municipal councils of mining communities within which each of the chosen mining companies operates. Through their roles as representatives of their respective communities, District/Municipal Chief Executive Officers (DCE/MCE) are well informed and up to date with

²⁶ GCoM – The Association of representatives of companies involved in mineral exploration, production and processing in Ghana.

²⁷ Galamsey – literally means ‘gather and sell’. We may also refer same to ‘Galamseymen - person who does Galamsey’

issues pertaining to the mining sector. These qualities of such leaders qualify them to represent the views of their mining communities/catchment areas.

3.5 Data collection

This section describes the research process, including ethical consideration and reflects on issues encountered and addressed during the field study.

3.5.1 Data collection process

Data was collected via semi-structured face-to-face interviews with participants as shown above. The plan at the outset was to present the researcher's provisional models (CRT, CLD, or sub-set of those models) that are relevant to the participants (discussants). Discussions were to follow the presentations structured by the researcher to elicit participants' feedback. The discussion was to be focused, via prompts based on the TOC CLRs (see Appendix 2 for the CLR's), with a view to correct, endorse and augment the diagrams. An interview guide was prepared with these focusing prompts as per the HEC application attached (Appendix 3).

A preliminary pilot study was conducted with five (5) second and final year PhD students who are Ghanaians and were willing to participate voluntarily to help the researcher refine the data collection protocol of this study. A final pilot study was conducted in Ghana with a researcher who has a background and knowledge of the gold mining industry in Ghana.

It was clear from these pilot studies that participants might find the CRT and underlying logic quite difficult to understand as captured in the comment below, considered to be representative of what other participants expressed during the pilot studies.

I am not an expert in this area, so I wouldn't be able to establish whether they [assumptions] follow the correct logic or not. It is an area that I am not competent in so whatever I will say relative to this [the provisional CRT model] will be conjecturing [Pilot study]

Whilst it was not clear at that stage whether the same difficulties in critiquing the logic would be experienced by those intended interviewees/discussants who had familiarity with the industry, a decision was made to modify the meeting plan for presentations and discussion prompts. The provisional CRT was broken down into segments and questions were adapted accordingly for each segment. (See Appendix 4 for the provisional segmented logic trees, provisional sub-models and full set of questions).

In this way, the researcher recognised the importance of avoiding over-prescription and of providing flexibility to participants/discussants during the data collection by embracing the use of semi-structured discussion prompts (Leidner, 1993; Milkman, 1997). Additionally, the researcher anticipated the busy schedules of discussants in their day-to-day activities as having the potential to impact on time available for discussion/interaction. Accordingly, the discussions were focused on the CRT only rather than using all the provisional models created in the preliminary analyses. Using a provisional model also ensured that the study did not have to start from 'ground zero'. The

above strategies of using semi-structured discussions based on the segmented provisional CRT model helped the researcher manage likely time constraints, provide flexibility and promote participation in data collection.

3.5.2 Ethical consideration

Ethicality of research may be considered in terms of its scientific quality, the safety and welfare of participants, and in terms of how it will promote respect for participants relative to their dignity and right (Flick, 2014). Such issues can be managed through compliance with code of ethics maintained by recognised ethical committees (Flick, 2014). This study involves human participants: hence their protection is crucial.

To ensure the research design meets these requirements, the study was subject to the strict guidelines of the HEC ethics committee of the Victoria University of Wellington and approved prior to the commencement of field work. To ensure protection for the study's participants (including individuals and organisations), discussants were given the opportunity to certify transcribed data pertaining to them and pseudonyms were used during reporting of views that could be traced to them.

Indeed, this study concurs with the suggestion by Gorard (2002) regarding the need to ensure protection for non-participants as well, especially where the outcomes of the study may have practical implications on the wider society, as is the case in the current study. The study provides protection for non-participants by ensuring its findings are as objective and impartial as possible. The study was not funded by any party/parties involved, so there was no conflict of interest.

In addition to the above, personal safety and security were also deemed critical for the overall success of the study. The researcher ensured to comply with all safety rules that apply to visitors on mining sites, including for example abiding by speed limits when driving on site, submitting to thorough searches at mine check-ins and check-outs, and ensuring to be in the right PPEs at all times when on the mine site.

3.5.3 Issues encountered and addressed

The researcher encountered and addressed several issues relating to data collection during the field study. These issues are discussed below, including recruiting discussants, schedules and geographical dispersion, and the quality of data obtained.

3.5.3.1 Recruiting discussants

It was originally planned to contact participants remotely via emails and receive their acceptance to participate prior to departing New Zealand for the field study in order to be effective and efficient in data collection. Some access guarantees are required as part of the ethical approval by the HEC ethics committee, perhaps to guarantee that access would be gained before committing the University into making travel arrangements, including flight bookings, or to minimise the risk on the part of both the University and the researcher.

Following the ethical approval in September 2018, effort was made to contact participants (including emails and telephone calls and on social media through WhatsApp chats). The response was less than encouraging despite support from colleagues and close associates in the industry whom the researcher knew personally based on prior professional background in the mining industry in Ghana. Apparently, there are strict data protection policies of the participants' institutions that forbade them to share company specific information.

Another major issue relates to a feeling of insecurity as a result of the '*Anas factor*'. Anas refers to Anas Aremeyaw Anas, an investigative journalist in Ghana whose main aim is to *name, shame and jail*. Anas uses covert means that have kept his identity unknown to the public to date, so that anyone could be the *Anas*. His exposés of some high court judges and FIFA officials linked to 'corruption scandals' (sic) are such that nobody wants to fall into this trap.

The above issue coupled with other 'political' motives of some participants as well as difficulty to obtain access (despite going through specified protocols) made it quite challenging for data collection and use of specific companies as case studies as originally intended. However, some participants expressed an interest and a willingness to participate if the study was not going to require them to share company-specific information. In fact, the data collection was designed to ask participants to share information based on their own understanding, knowledge and involvement with the industry. Hence, participants were not required to share company-specific information.

After arriving in Ghana and meeting with people face-to-face, the researcher found other participants (including some who had declined to respond to emails and calls) who were willing to take part.

Nevertheless, busy schedules and geographical dispersion of participants presented another challenge as discussed below.

3.5.3.2 Geographical dispersion and busy schedules of participants

Geographical dispersion of participants of the study constituted another key challenge. Some were recruited in Greater Accra where most of the national level institutions and corporate head offices are located. Others were recruited at the firm level and involved travels between the Accra and across various mine sites and communities in the Western Region (including Tarkwa, Wassa Akyempim and Bogoso and Prestea), the Ahafo Region, and Eastern Region. Some of these locations are in remote areas, posing accessibility challenges, although a good number of these companies are concentrated in the Western Region. The Ashanti region was not visited after learning that the Obuasi mine, which is the largest mine in the region was under care and maintenance at the time of the study in 2018.

Another major challenge was the busy schedules of participants which made it practically difficult to schedule appointments with them, particularly those at the firm level, despite their willingness to participate. In most cases the appointment was called-off and rescheduled. However, there was

no guarantee for the new appointment – in some cases, the researcher arrived on site for the rescheduled appointment and waited the entire day without discussions. This situation occurred in almost all of the first 7 interviews.

On one such occasion, the appointment coincided with a week-long visit of shareholders of the company in question and had to be rescheduled again. The participant later admitted that even though he knew about the visit, he took the chance to prevent calling off the meeting for the third time. In other situations, the meeting took longer than usual to complete as the researcher had to stop in the middle of the discussions for participants to attend to work-related phone calls and other matters requiring their attention.

In a meeting that began on schedule at 11am with the hope of finishing by 12 noon (lunchtime), within the first 20 minutes, the discussions had stopped 4 times already, for the participant to attend to an emergency situation relating to the loss of one of the transformers at the plant where he is directly in charge. The meeting was eventually called-off and had to continue later after close of business at the participant's residence on the mine site on the participant's request.

Also, the busy schedule of participants in the context of this study can be illustrated with the comment below which expresses how some managers have to make a value decision on aspects that is trying to get their attention on a daily basis.

...I know, we make a value decision on what is trying to get our attention. And if what I am handling now, something comes up and I see that it is more of a bigger risk, I will drop what I am doing now and go and handle it.

But whilst a bigger risk is seeking our attention, we have less important risks also trying to get our attention.

This [respondent points to document sitting in an in-tray] for example are some of them – they were given to me on Monday and I said go and put it down – they can wait. But there are certain things that can't wait.

Also, as we were talking, a 'bigger' manager came behind you [the researcher]. So, I wanted to ask you to pause. But he listened to the conversation and signaled me to go on. So, whatever brought him here, he has made a decision that it can wait.

So, my job is to finish and call him to say, boss you were looking for me – can we do the talk – you understand...

The above challenges coupled with other 'political/security' issues led to very slow progress of the field study. Many of the proposed interviews coincided, others got postponed a couple of times, and others lost interest after showing them the provisional CRT model which seemed quite alien to most of the participants.

3.5.3.3 Level of quality of data obtained

In a multi-framing study like this that emphasizes providing voice to stakeholders at different levels to express their viewpoints, concerns and questions, data quality can be considered in terms of *saturation of data* and also equally importantly, in terms of *demographical attributes* such as *status* and *gender of the participants* involved.

In terms of data saturation, the nature of the data collection approach, based on the provisional CRT model was such that participants largely shared similar views and concerns about issues affecting the industry.

At the firm-level for example the same or similar issues and concerns were raised by participants regardless of whether they were interviewed from company 1, 2, 3, 4 or 5. Perhaps this may not have been the case if participants were asked to share company-specific information. The same can also be said about participants at the community level and participants who were interviewed at the national level as well.

For example, members of mining communities repeatedly raised issues that reflect concern about employment, community infrastructure challenges, livelihood challenges and a feeling of lack of effective engagement by both the government and mining companies as the main issues affecting different communities. Representative views were thus sampled and reported to avoid repeating the same viewpoint over and over again. Considered as an independent participant, the viewpoint of an industry expert was also sought. In almost all cases, viewpoints confirmed and validated the viewpoints surfaced at the national firm or community levels.

Regarding the demographical attribute of status, all participants interviewed at the firm level are managers in their respective functions. At the national level, the study involved participants who are regulators whilst others are senior officers of various mining institutions sampled for the study. The industry expert involved in the study also doubles as a leader of a mining community and held managerial roles in the industry.

Representatives of mining communities with relevant educational background were also interviewed. A representative viewpoint about CSR that is captured in section 4.2.2.5 is for example, attributed to a participant who is not just a member of a mining community but also, he holds an MSc degree with a recognised university in Ghana and has working experience with the industry.

Indeed, participants from the ASSGM sector such as concession owners, Galamsey operators and licensed gold buyers may have limited background in formal education. However, their rich experiences in their respective sectors contributed to the quality of data gathered in this study.

As shown in the Figure 3.3 below, representativeness in terms of the number of female vs male participants seems to reflect the nature of gold mining industry which is largely male-dominated. Indeed, the researcher went for positions and roles. It happened that most of the roles involved

were held by men. Nevertheless, there were two women who initially agreed to participate. However, it turned out that only 1 of them was available for interview during the study.

The issue of gender is thus, analysed in relation to their power dynamics in Chapter 5 (Figure 5.3) and additionally addressed later under limitation section in Chapter 7 of this study. However, the other challenges leading to slow progress were mitigated somewhat by attending conferences relevant to the study, where a number of participants were later recruited, and by maintaining contact with supervisors while away doing the study in Ghana.

These strategies and how they each contributed to the success of the study are elaborated next.

Figure 3.2: Breakdown of participants

3.5.3.4 Attending conferences relevant to the study

Two main conferences took place which coincided with the study. The Goldfields Suppliers Conference on the theme: “Achieving Sustainable Supply Chain through Partnership” took place in Tarkwa at the Goldfields Official Club House on June 10. Secondly, the Ghana Mining and Energy Summit (a Mining Exhibition / Conference), organised by the Ghana Chamber of Mines, was held from 12th to 14th June on the theme: Harnessing Mining and Energy Potential to Accelerate National Development. This summit brought almost all stakeholders of the mining industry in Ghana together in Accra for exhibitions, and discussions on wide-ranging topical issues pertaining to sustainability of the mining industry in Ghana, including aspects such as the mining value and supply chain and local content involvement in the industry, which have direct relevance for the purpose of this study.

Attending these conference sessions, particularly the Mining and Energy Summit, brought exposure and led to direct contact with key managers of the various mining companies,

government officials (including officers from the various national institutions linked to mining industry), and executives from GCoM and other industry experts and local suppliers. Prior to the conference sessions, the total number of interviews gathered between April and early June stood at 7. Following the conference, several more interviews were conducted, and by 29 June, when the field study was successfully concluded, the total stood at 19 interviews.

The Ghana Chamber of Mines, the Environmental Protection Agency (EPA) and the Minerals Commission (MinCom) played a much more important role than one could have imagined. Contrary to public perception that access to such institutions can be hard to arrange, all actors provided the best of support during the field study, granted interviews and facilitated meetings. However, this support came only after meeting face-to-face with these stakeholders, at which point they could ascertain that I am a Ghanaian.

The words of the Deputy Chief Executive Officer of MinCom and that of an Official of the GCoM indicate this support:

*I did not make it difficult for you to see me. Don't make it difficult for others to see you.
We all have a role to play to move the country forward (Representative from MinCom)*

*We would be more than happy to review your study and possibly endorse it
(Representative from GCoM)*

In addition, officials from the EPA supported the research immensely. Apart from participating in the study, they also served as a channel through which contact was made with some participants (traditional authorities) and operators of ASSGM activities, and a participant of the LSGM sector in their network as regulators.

3.5.3.5 Staying in touch with supervisors whilst away

Staying in touch with supervisors also proved very helpful, and this was achieved through video calls via Skype and through WhatsApp Chats. Poor connectivity to the internet was a key challenge but this was managed after buying an internet booster (Turbonet) from one of the telecommunication service providers in Ghana. Also, where necessary, information was sent via WhatsApp, particularly information relating to the meetings with Galamsey mining operators.

Other important strategies suggested by supervisors included record keeping, making it possible to track the sequence of activities that took place during the study. Finally, and equally importantly, it bridged the gap between the researcher and supervisors, bringing them into a common loop whilst away, and allowing the latter to appreciate the practicality of issues in the study context far more than would have been possible otherwise.

3.5.4 Further factors impacting the quality of data collected

This section covers other pertinent issues encountered during the field study that impacted on the data collected. It starts by reflecting and critiquing the data collection approach based on the provisional CRT.

Following this, prior considerations are outlined whilst addressing aspects relating to presenting the model for feedback.

3.5.4.1 Critique and rationale of CRT as a method for data collection

By using presentation of the provisional CRT model, this study engaged discussants in a very interactive way to discuss the key issues that relate to them in detail without taking too much time. Indeed, the above approach may be limited when it comes to getting for example, company specific information. Nevertheless, it encourages participants to share their views based on their experiences, understanding, knowledge and insights and involvement with the industry as reflected in a participant's evaluation of the data collection method below.

Oh, I think the most important thing about research is going out there to find out what answers your research questions. Therefore, any methodology that gives people the comfort to air their views is not bad. The only thing is that you should be able to identify flaws and weaknesses in the given methodology.

Because you want to encourage people to talk and at the same time you are also assuring them that "listen you are free not to talk about company specific information" so you can't really push the person to give you or substantiate the information.

So, I think that is one of the flaws of the approach so you need to put a mechanism to overcome that. But certainly, it encourages people to talk [general feedback on data collection approach based on the CRT].

However, the rationale for presenting the provisional diagram is that the gold mining industry is too complex to get productive responses from interviews in the traditional way, starting from a zero base. Using the diagram provided a basis for comments by discussants to share their views on specific assumptions of the provisional CRT, making the approach to mimic or reflect a semi-structured interview (Leidner, 1993; Milkman, 1997). Previous studies such as Moore and Mabin (2014) has used this technique successfully. Scott (2020) has similarly demonstrated the practicality of the approach in his thesis. That author for example, sought to gain better understanding about problems facing managers in budgeting processes, using a CRT to represent the literature review on budgeting and applying the underlying logic of the tool to then highlight the cause-effect relationships between various issues identified.

Results from Scott's study indicate that managers of the studied organisations perceived they face similar problems as those outlined captured by the CRT. This suggests the practicality and effectiveness of using a provisional CRT as a tool or instrument to gain better understanding about the study's context. The author's approach parallels and sets the stage for the use of a similar approach based on a CRT grounded in prior analyses of the mining industry in Ghana to be used with confidence.

3.5.4.2 Prior Considerations and Outcomes

In the original plan, each presentation and feedback session with participants was expected to last 30 minutes in addition to a 1-hour feedback session. Follow-up discussions were intended to last the same duration as the feedback sessions. The original plan further anticipated that in the event that discussants cannot offer immediate feedback after the presentation, a follow-up discussion would be used to get such feedback within a week of the presentation.

However, due to time constraints on the part of participants, and other challenges, including geographical location, participants preferred to offer immediate feedback, making follow ups as originally intended, needless. Also, on average, each presentation and feedback session lasted for an hour, reflecting the need to adapt the interviews to fit the busy schedules of the interviewees.

Another important consideration was that because of the limited level of formal education that discussants within the informal mining (Galamsey) sector are likely to exhibit, this study deemed it necessary to use focus group discussions at this level instead of presentations which may require some level of comprehension and judgement beyond the level of such participants. Hence, although discussants at this level were asked relevant questions based on the provisional model, it was done in accordance with requirements of focus group discussions (Hennink, 2013).

Members of mining communities were also to be represented by District Chief Executive Officers as such actors were considered to be well-informed about issues pertaining to the mining sector that concern members of mining communities. However, several attempts to get such leaders to interview proved unsuccessful. It was very hard to get them to respond to emails, telephone calls and text messages.

At the office of one of these DCEs, the researcher was overwhelmed with the number of visitors (including chiefs and their subjects) queueing for their turn to see the DCE. Perhaps, busy schedules of DCEs may have contributed to their non-response but also, political motivations could not be ruled out, particularly due to the fear of the '*Anas factor*' as discussed under section 3.5.3.1 above.

Nevertheless, it was possible to speak to some local authorities. Hence, the non-response of DCEs did not adversely affect the study although it added to the time constraint of the researcher.

3.5.4.3 Presenting the model(s) for feedback

Presentations were delivered to the study's participants individually. The focus of presentations differed depending on level and type of participant. For instance, a participant from Environmental Protection Agency at the national level was approached with issues relating to aspects captured on the provisional CRT that relate to assumptions about the environment.

The feedback session after each presentation was designed to allow participants to express their views about their interests, demands, expectations and wishes, and to give them the opportunity to:

- ❖ Endorse aspects that are right about the model
- ❖ Correct aspects that are wrong in the model and
- ❖ Augment where important aspects are missing from the model(s), from their perspectives.

Due to the complexity captured by the provisional CRT (Appendix 1), the researcher found it necessary to break it down for better understanding by participants. For example, to invite participants to share their views on the overall UDE, the research made the follow statement and asked the questions as follows, after introducing the provisional CRT and highlighting the overall UDE: This UDE is italicised in the statement that follows. A similar approach was used to ask questions that involved testing of relationships as will be shown in the appendix section.

Statement:

The provisional CRT of gold mining industry in Ghana suggests that *140. Benefits for Stakeholders (State, communities & investors) fall short of expectations* (see provisional CRT Appendix 1).

Question:

- a) Do you think this overall UDE (undesirable effect) of the CRT (shown in...) is appropriate?
- b) Do you have any doubts about the way the overall UDE is captured above or the way in which it is stated?
- c) Do you think we should be more concerned about something else as the overall UDE of the sector other than what is captured above?

A typical Response:

*It is a general refrain! You will get **government** saying that we **don't get enough** from the **mining companies**; you have the **community members** also saying the mining operations are **not impacting our lives** as we **expected**; and then you will hear companies also saying that the **cost environment** is too high for us and as a result we are also **unable to make profits in this country** and that we are **less competitive** when we operate in Ghana relative to... then they will mention a number of countries for you.*

This and other typical responses are provided in Table 3.2 below whilst the rest of the interview prompts, and recruitment email, plus participant consent forms are attached in appropriate sections as Appendices

3.5.5 Managing the credibility and validity of data

In this research, it was considered that starting from 'Ground Zero' would be too slow, particularly with numerous models to build for the various frames. Accordingly, models were pre-constructed,

such as the provisional current reality tree (CRT) developed through an initial review of the contextual literature on the industry. As indicated, in addition to gathering opinions to validate, corroborate, augment or correct the researcher's pre-constructed models, the study also benefited from validating its data using the logic protocols described as the TOC categories of legitimate reservation.

Managing the validity using the approach described above is consistent with (Balderstone, 1999) who suggested and recommends the use of the CLR²⁸ protocols to enhance user and researcher confidence when building systems models. The approach also parallels what prior studies involving the use of pre-constructed diagram to seed discussions, such as Moore (2009) and Peace (2019) who used IO Maps/Goal trees, and Scott (2020), who pre-constructed a CRT, have applied and proven effective.

Also, on arrival in Ghana – appreciating the difficulty participants would have comprehending the provisional CRT in a short meeting, the model was broken into segments to make it easier to comment on. However, the use of even simply presented CRT models proved to be challenging for the time available with most participants/groups. Sometimes the logical relationships were commented on. In some circumstances where the logic was challenged, it resulted in an improved understanding of an entity than initially understood/captured by the provisional CRT based on the literature. Respondents often provided valuable background information rather than directly critiquing the logic of the CRT. The diagrams served very well as a platform for a focused discussion. The responses were very insightful and led to broader understanding of the industry context than had been captured in prior studies about the mining industry in Ghana. Typical examples reflecting the discussion sessions can be offered as follows.

3.5.5.1 Typical examples of issues discussed

At the national level participants were asked to validate the cause-effect relationship underlying an entity (*90. Environmental degradation and pollution associated with gold mining rises*). They replied with detailed information about the mining industry that was not directly sought but was nevertheless very useful. Participants provided background information on historical events about environmental misconduct of a LSGM company that had led to development of the environmental reclamation and sustainability bond agreement (ERSBA) regulatory framework which now governs the management and analysis of the impact of gold mining industry in Ghana. Although the provisional CRT had captured issues relating to the environmental aspect, information about the ERSBA had not been surfaced. Participants voiced their opinions that the ERSBA is working perfectly by fostering compliance by the LSGM sector specifically whilst admitting or expressing environmental challenges posed by ASSGM sector as a result of growing illegalities of the sector.

²⁸ The CLR protocols are highly recognised and widely used amongst scholars in the field of TOC. A summarised version of the CLRs demonstrating how to translate the CLRs into everyday conversation is offered by Dettmer (1997, p. 339) and applied in (Mabin et al., 2001) as offered in Appendix 3

Comments on another entity with relevance for the mining industry value/supply chain arose when asking participants to validate the cause-effect relationships leading into (80. *Value-adding activities are undertaken/benefit overseas firms*). It resulted in passionate discussions about issues that reflect concerns and criticisms, particularly, about the export-driven value creation model of the industry. This was to such an extent that some participants related the origins of the export-driven model questioning its validity and appropriateness as a colonial legacy and calling for change.

Similarly, when participants at the firm level were asked to validate the cause-effect relationships giving rise to an entity that relates to the achievement of the business goal (104. *LSGM sector struggles to achieve economic goals*), they tended to offer (insightful) explanations, sometimes attributing blame for their problems on the government and mining communities for being insensitive to their needs. They were more likely to describe these details than help with the cause-effect logic. Key topics discussed by the firm level include the CSR activities of mining companies, and concerns about the regulatory (particularly, the fiscal) environment, and unrealistic community demands and expectations.

At the community level, participants were more interested in sharing their views and thoughts about an implied lack of a formal recognition and voice in the sector's decision making and raised concerns about employment and infrastructural development when asked about cause-effect relationships giving rise to issues that related to them. These entities are (110. *Social benefit of gold mining is less than desired*) and (100. *Economic wellbeing of mining communities is poor*). Validating the cause-effect relationships giving rise to these entities did not matter much to participants at the community level; rather they preferred pointing out the short-comings of both the government and mining companies, highlighting issues reflecting the lack of meaningful engagement with such communities.

As indicated earlier, even though the respondents were more likely to provide background information about aspects of the provisional CRT model that related to them, than provide direct comments on the model, the resulting insights improved the researcher's understanding about the industry context, which complemented with insights from the prior literature, helped to refine and develop a more comprehensive CRT and related models that help to capture the realities about the industry.

Hence, the resulting insights from the field study will shortly be reported in Chapter 4, providing rich background and insights for fuller analysis in Chapter 5, using the complementary lenses of soft-systems frameworks that constitute the multi-framing analyses of this study.

3.6 Analysing data

This section looks at the nature of responses in addition to three main phases relating to analysing the data. Phase one involved populating the data according to three key categories or themes and assigning code names as shown in Table 3.3 below. Phase two involved presentation of data. Phase

three is frame analysis. Before considering these aspects, it is important to address the nature of responses as considered below.

3.6.1 The nature of responses

Table 3.2 below provides typical examples of the nature of responses from participants during the field study. Some of these responses reflect an intent of agreement with justification, whilst others attempted to deny but ended up in agreement. Also, other views reflect agreement with corrections with some showing agreement in affirmation whilst others reflected a neither agreement nor disagreement as illustrated in Table 3.2 below. The provisional CRT used for data collection is provided in Appendix 1. It is important to note that the numbering in Table 3.2 refer to entities' numbers in the provisional CRT, and they serve for identification purpose only.

Table 3.2: Example responses by participants and interpretation

Entity existence?	Nature of response	Interpretation of response
140. Benefits for stakeholders (State, communities & and investors) fall short of expectations.	It is a general refrain...You will get government saying that we don't get enough from the mining companies; you have the community members also saying the mining operations are not impacting our lives as we expected; and then you will also hear companies also saying that the cost environment is too high for us and as a result we are also unable to make profits in this country and that we are less competitive when we operate in Ghana relative to, then they will mention a number of countries for you.	Agreement in affirmation
115. Shareholder expectations are not met.	I am not a shareholder. So, I wouldn't be able to establish whether they achieve their expectation or not.	Questionable Entity (Neither agree nor disagreement)
120. Employees of LSGM sector are faced with repeated episodes of redundancy	Job Redundancy to me, is the best way to exit the business. At least you are given something to go home with. It is a common managerial phenomenon...The logic of redundancy is to survive when we cannot make it and when we have extra hands doing no job...	Agreement with justification.
100. Economic wellbeing of gold mining communities remain poor.	Indeed, their [Communities'] expectations is quite difficult to measure because maybe today they want a good school; tomorrow they want a good hospital; the other day they want jobs for their youths. We have not decided to change the model. For instance, we mine in the country and export everything and import	Agreement with justification.

80. Value-adding activities are undertaken/benefit overseas firms.	most of the inputs. So what will remain in our country are few services that some of our local businesses can provide, the taxes that the government can collect, and the salaries paid to employees. The chunk of the money will dissipate or leave the country through the importation of inputs, and exportation of output and significant profits are also repatriated	Agreement in affirmation
70. Gold mining involves use of unsafe production methods that endangers the environment.	It is a fact, and that is mining for you. The available technology is that you excavate, do blasting and all of that destroys biodiversity. These are facts, and the impact on human health too is also true once you are destroying the environment. But then there are mitigation measures in place	Agreement in affirmation with supposed remedy
29. Managers lose focus	I wouldn't say lose focus – we get distracted. You don't get the time to do your strategic thinking. You may be in the middle of something and you get a call on your professional duties and move you from one subject to another subject.	Agreement with correction. (see section 6.9.1.1 for details)
15. LSGM sector pursues functional objectives at firm/departmental level	I wouldn't say that pursuing functional objectives – like for instance, my function here is to produce gold from what the miners bring me. That is my objective or that is my main business here. I need certain things to work towards this objective. And to me a manager should be able to manage him or herself appropriately to achieve the target you have been given. So if at a point, the structure is not supportive.... For instance, if I end up having to chase orders every day when there is a purchasing outfit who is supposed to be looking at orders for you then it becomes an issue.	Agreement (although initially tried to deny)

3.6.2 Populating the data using tables

After each discussion/interview session, data was captured for that participant each of whom was assigned a unique code to differentiate from other participants. These codes were chosen to reflect/categories participants according to the different levels of analysis (national, firm and community) of this study.

The first participant interviewed from the national level is, for example, assigned a code NL01 whilst the code FL01 was assigned to the first participant interviewed at the firm level, and the first participant from the community level was coded as CL01, as shown in Table 3.3 below.

Viewpoints were then evaluated and categorised into four groups based on whether they shed light on the natural, social or the fiscal environment, or related to the gold mining supply chain which were categorised under industry structure. They were also separated according to the level represented.

Table 3.3: Table of Interviewees with Codes

Category	National Level	Firm Level	Community Level	Industry Export	Total No. of Viewpoints
The Natural Environment	NL01 NL02 NL03a	-	-	IE01a	4
The Social Environment	NL03b	FL01 FL02 FL03 FL04	CL01	IE01b	7
The Fiscal Environment	NL04 NL05	FL05	-	-	3
Industry Structure	NL06 NL07 NL08	FL06	CL02 CL03 CL04	IE01c IE01d	9
Total	9	6	4	4	23

Some of the interviewees had experiences that spanned government agency, corporate (internal and external consulting insights as well as holding positions in the community). Thus, some of the interviewees could have been listed under multiple categories because they have such a broad range of experiences across the gold mining industry in Ghana.

However, rather than listing such participants under multiple categories, they were assigned to only one category depending on the capacity in which they were interviewed, suggesting thus, that Table 3.3 above understates the collective experience of interviewees. In terms of feedback/comments, most of the interviewees talked from more than one perspective (sometimes personal, for the company, and for the community).

3.6.3 Frame analysis

The process of analysing the data using the different methods within a multi-framing approach (Figure 2.1) is described in Chapter 2, which outlines each of the various analytical tools, including stakeholder analysis, supply chain analysis, Causal loop modelling and TOC analysis that are operationalised later in Chapter 5.

The following provides relevant details about each of the frames.

3.6.3.1 Stakeholder analysis (SA)

Whilst some suggest that the ultimate goal of organizations is to make money (Friedman, 2007; Goldratt, 1992), they need to do this by creating or providing value to a spectrum of broadly defined stakeholders whose stakes and interests must be addressed if the organization is to survive and thrive (Eden & Ackermann, 2013; Freeman, Harrison, & Wicks, 2007; Mitchell et al., 1997).

Bryson, Cunningham, and Lokkesmoe (2002) argue that the conduct of stakeholder analysis helps to understand and address ‘wicked’ (complex) problems for the common good of key stakeholders.

Drawing from (Elias, 2016b; Elias et al., 2002), stakeholder analysis can be approached by completing a range of analytical phases. For the purpose of this study, the rational, process,

transactional, and dynamic levels stakeholder analysis, and the stakeholder management capability phases in (Elias et al., 2002) are key.

Table 3.4: Systematic Stakeholder Analysis approach (Elias et al., 2002; Elias, 2016).

Analytical Levels	Key Requirements	Key assumptions
Rational level stakeholder analysis	a) Develop a stakeholder map b) Prepare a chart of specific stakeholders of the industry c) Identify the stakes of the stakeholders d) Prepare a power versus stake grid a) Identify specific projects	A better understanding and knowledge about the diversity of stakeholders that constitute a project or an industry is critical
Develop a project charter	b) Make a problem statement c) State the impact of the project on the business d) Make a goal statement e) State the start/finishing date where possible f) identify specific stakeholders g) identify the needs of each stakeholder	It is possible to incorporate stakeholder needs into a project charter having completed a rationale level stakeholder analysis and gaining insight about their needs
Process Level Stakeholder analysis	a) Understand processes used by the industry to implicitly or explicitly manage its relationship with stakeholders b) Analysing the efficiency of the transactional process c) Deduce whether the above fit with the stakeholder map developed at the rational level	A meaningful engagement with stakeholders is based on a well-established consultation processes. Such consultation processes must be cost efficient, and effective (allow feedback or provide voice to all stakeholders consistent with the stakeholder map
Transactional level stakeholder analysis	a) understand the set of transactions and bargains between the industry management and its stakeholders b) Deduce whether the transactions (negotiations) fit with the stakeholder map developed at the rational level and the organisational process for stakeholders	Successful transactions are with stakeholders are built on understanding the legitimacy of the stakeholder and having processes to routinely surface their concerns
Stakeholder management capability	Determine whether or not the industry: a) Understands its stakeholder map b) Has well-established consultation processes c) Is characterised by win-win relationship or otherwise	Stakeholder management capability can be determined based on the industry's understanding its stakeholder map, the presence of well-established engagement processes, and the nature of transactions which it carries out the achievement of project purpose its stakeholders
Stakeholder acceptance	Understand stakeholders in terms of whether they are: supportive, neutral, or opposed to activities of the industry	Stakeholder acceptance can be analysed based on whether they are: supportive, neutral or opposed.
Dynamic level stakeholder analysis	Analyse possible changes in stakeholder: a) Power b) Legitimacy c) Urgency make relevant recommendations for action/improvement	The importance of stakeholders can change over time as their power, legitimacy and urgency change. Keeping track of such dynamics and constantly updating the list of salient stakeholders is critical

3.6.3.2 Supply chain analysis frame

The mining industry/sector, like any other organisational system, must be operationally efficient and effective if it seeks to maximise value to its stakeholders. Whilst Porter (1985) suggests organisations can establish competitive advantage through the value chain, others including Lambert and Enz (2017) argue that we must compete through effectively harnessing the supply chain.

In findings that have relevance to this study, Porter (1990) emphasises a need to innovate to overcome local disadvantages rather than outsourcing them; and to develop domestic suppliers instead of relying on foreign suppliers.

Consistent with the above views, this study recognised the importance of value chain and supply chain analysis of the gold mining industry in Ghana. A comprehensive value chain (VC) approach – comprising everything from extraction of raw materials to delivery of products to customers – such as the ore to market approach by McKinsey (Görner et al., 2020) is particularly critical.

Such a comprehensive VC approach makes it possible to explore and map the horizontal relationships involved in the sequence of operations – ore reserves, then exploration, mining, processing, and refining, to manufacturing and distribution to final consumers in the form of finished products or in the form of investment activities. Such analysis then facilitates the assessment of value-added activities throughout the chain and the end-value of Ghanaian ore that reaches the end of the chain.

It also facilitates understanding the nature and extent of value that accrues to the average Ghanaian. Similarly, it facilitates understanding of the value-adding opportunities along the horizontal chain where full benefit is not currently being exploited and informs how such unexploited opportunities could be capitalised on to maximise outcomes.

A supply chain (SC) approach, on the other hand, as Lambert and Enz (2017) describe, emphasises management of the forward and backwards flow of information (and money) and products. This necessarily involves the management of customer service and customer relationships; of supplier relationships; of demand and order fulfilment; of manufacturing (operations) flow; of research and development; and the management of reverse flow (Lambert & Enz, 2017).

However, an SC approach as suggested above, whilst having the potential of a system-wide improvement, also increases the complexity and coordination requirement, which can constitute a managerial challenge.

Also, as shown in Figure 3.3 below, Lambert and Enz (2017) offer a framework for understanding the complex structure of relationships that make up a supply chain.

Figure 3.3: Structure of relationships that make up a supply chain

The above framework will be applied and modified to suite the need of this study. The original framework with legends and detail description, can be provided by (Lambert & Enz, 2017, p. 6). Although the focus of the framework is on the firms in the manufacturing sector, it can be adapted for use in the context of the gold mining industry supply chain – conceptualised in Figure 5.4. Specifically, the framework will be adapted with modification to map the supply chain of specific items, namely tyre supply chain (Figure 5.6), and gold supply chain (Figure 5.7) in Chapter 5.

As Schragenheim et al. (2009) imply, complexity and coordination of a SC approach can be managed by embracing the TOC management philosophy and developing the capability to use relevant TOC tools such as the Drum Buffer Rope or newer versions such as the simplified Drum Buffer Rope (S-DBR) or the enhanced version. They also encourage the use of the TOC thinking process (TPs) tools, for more effective solutions. For the purpose of this study, relevant TP tools will be considered as outlined under section 3.6.3.4 below.

First, though, system complexity is considered using Causal loop modelling.

3.6.3.3 Causal loop modelling (CLM) frame

One of the main challenges facing government is how to manage the complexity of Ghana's export potential of gold mining for economic development and poverty reduction, attractiveness of Ghana for foreign investment and development of local capacity/capability.

As Kim (2001) argued, the greatest leverage for effective decision making and problem-solving lies in understanding of the systemic structure of problems. Thus, this study uses causal loop modelling (CLM) as part of its analysis to explore the structure of the relationships between seemingly unrelated variables that are embedded in Ghana's export potential. As part of this, behaviour over time (BoT) graphs will be plotted for FDI in-flows, and for comparing the ASSGM

and LSGM sub-sectors. In addition to these, causal loop diagramming (CLD) will be used to analyse the effect that Ghana's export potential of gold has on dynamics within the industry. This would enable a more detailed description of the system's problems to inform appropriate actions.

A comprehensive discussion about systems archetypes (generic structure of problems) is offered in the seminal book, 'The fifth discipline' (Senge, 1990, pp. 378-390). Key amongst them are the fixes that fail (FtF), shifting the burden (StB), and success to the successful (StS) systems archetypes.

Also, Maani and Cavana (2007) provides a framework for causal loop modelling as follows:

Table 3.5: Causal Loop Modelling approach (Maani and Cavana, 2007)

Steps	Activities
1	Identify main variables
2	Draw behaviour over time charts for main variables
3	Illustrate relationships among main variables using causal loop diagrams (CLD)
4	Discuss behaviour over time of the dynamics implied by the CLD
5	Identify systems archetypes that would describe high-level causal patterns
6	Identify key leverage points
7	Develop intervention strategies

Also, Reid and Shoemaker (Reid & Koljonen, 1999) compare SD and CRT / FRT. Although the CRT diagram from TOC performs a similar function as the CLD, it does not help to create the visual depiction of systems archetypes in as clear a manner as the CLD does. Also, a CRT may lack the robust capability to fully capture dynamic complexity (Reid & Koljonen, 1999). On the other hand, the CLD, whilst overcoming this shortfall of the CRT and allowing us to validate core problems surfaced, using the CRT, is limited when it comes to surfacing underlying assumptions in the way the CRT offers (Reid & Koljonen, 1999). This makes CRT and CLD to complement each other for more effective identification, and solution to core problems.

Additionally, previous studies have demonstrated the practicality of complementing the CLD with other TOC tools (Mabin & Davies, 2004; Mabin et al., 2006) but these do not combine the CLD with CRT. Hence, in this study, CLD and CRT will be used to explore complementary benefits.

In particular, CLM helps to draw conclusions and recommendations based on the particular characteristics or relationships, exhibited through problems facing the mining industry in Ghana particularly via CLD as shown in Figure 6.5 in Chapter 6.

3.6.3.4 TOC Five focusing steps

TOC²⁹ provides a framework for improving the performance of any system, developed by Goldratt in various books, presentations and videos, as well as by many other practitioners and scholars,

²⁹ Theory of constraints can be summarised as a multi-faceted systems approach developed specifically to assist organizations and individuals to manage change and development in a process of ongoing improvement using logic-based tools and appropriate methodology/frameworks capable of helping to manage and break systems constraints no matter how complex such constraints may be (Dettmer, 1998; Goldratt, 1992; Mabin & Balderstone, 2003).

evolving into what is now viewed as a systems methodology for managing any system (Cox & Schleier, 2010; Davies et al., 2005; Dettmer, 2007). In his earliest book, a novel: *The Goal* (Goldratt, 1984), Goldratt showcases the 'Five focusing steps' (5FS) method used to turn around a failing company (and save the protagonist's marriage!). The TOC's 5FS method is verbalised as:

- ❖ Step 1: Identify the constraint blocking achievement of desired outcome
- ❖ Step 2: Decide how the constraint can be exploited
- ❖ Step 3: Subordinate all other resources to focus on exploiting the constraint
- ❖ Step 4: Elevate the constraint (if previous exploitation efforts fail to deal with it)
- ❖ Step 5: Repeat the process from step 1 if the constraint has been broken

The approach is widely accepted and used by some of the largest and most successful organizations in the world including Boeing, General Motors, and Ford Motor Company, and its impact has been summarised in (Mabin & Balderstone, 2003).

In the sequel to *The Goal*, *It's Not Luck*, Goldratt (1994) presented the TOC Thinking Process (TOC TP) tools³⁰ based around 3 key questions for any change process: *What to change*, *What to change to*, and *How to cause the change*. This laid the foundation for an expanded set of 5 key questions which can be used by practitioners to answer when exploring whether a system has potential for improvement, designing how that improvement may be achieved, including managing the process through to implementation:

1. Why change?
2. What to change?
3. What to change to? (They actually have To what to change? Which is grammatically correct but sounds stupid imho and I prefer the more direct version here)
4. How to cause the change?
5. How to measure and sustain the change?

The above question structure is referred to as the Change Question Sequence (CQS) and can be used by a researcher to guide the discussion protocols to be used with participants. Both the 5FS and CQS represent the process of ongoing improvement (POOGI) (TOCICO Dictionary, 2012, p. 34). The TOC TP tools have been described and discussed in detail elsewhere e.g. (Dettmer, 2007; Mabin & Davies, 2010; Scheinkopf, 2010). In this study, both processes of ongoing improvement will be used, the 5FS for more immediate tactical, operational concerns, and the CQS for more strategic analysis. The relevant TP tools will be described next, to outline how they are used (intended to be used) in this study.

³⁰ TOC-Thinking Processes (TOC-TP) tools – logic-based tools developed to assist with the identification and management of, especially, policy constraints of a system (Dettmer, 1998; Goldratt, 1994). Such constraints, by their nature, constitute 'wicked problems' (Checkland et al., 2006), lacking structure and need to be structured to facilitate understanding of them (Mintzberg, Raisinghani, & Théorêt, 1976)

3.6.3.5 The TOC thinking process tools

As indicated in the section above, the TOC thinking process tools (TPs) are a suite of diagramming tools for problem structuring and problem solving through to implementation. An important feature of the TPs is that they are logic-bound (Goldratt, 1994), and can provide a structured/rigorous process for identifying cause-effect relationships embedded in the gold mining industry. By leading the researcher to uncover cause-effect relationships, the TPs will also help to develop actionable insights by using the logic protocols to challenge, and hence correct, underlying assumptions (particularly taken-for-granted assumptions). By questioning and correcting (taken-for-granted) assumptions, practical solutions could emerge and hence, lead to an informed recommendation(s) that can be communicated using the TOC CQS structure (along with the 5FS methodology).

The current reality tree (CRT) and the Evaporating Cloud (EC) are the 2 best-known and most widely used tools of the thinking process tools as suggested by Kim, Mabin and Davies (2008). They are used to identify the root cause limiting desirable outcomes and identify possible solutions.

Indeed, there are a diverse range of tools that constitute the TPs, including lesser-used tools such as the negative branch reservation (NBR) used to identify and address negative side effects of a proposed solution as part of the FRT development; transition tree (TT) for planning the sequence of implementation of a given change; and the strategy and tactics tree (S&T) for enabling focused and sequential implementation. A practical example of an S&T, including the specific questions it seeks to address (i.e. the ‘what for’ and ‘how to’) is outlined by (Barnard, 2010) whilst Mabin, Davies, and Kim (2009) provide a comprehensive coverage of the application of the TOC thinking process tools.

A literature-based provisional CRT was developed and used for data collection in the context of this study. It is provided as Appendix 1 towards the end of this section which will be revised later. In addition to the CRT tool, others such as goal tree (GT), evaporating cloud (EC), future reality tree (FRT), and the prerequisite tree (PRT) also known as the intermediate objectives map (IO map) were envisioned to be used in the context of this study as time allows.

Hence, further details of each of these TPs intended for this study are outlined. However, before providing these details, it is important to note that although different TP tools are designed to deal with specific aspects, they complement each other in ways that can be depicted using the CQS (Mabin, 2013), as shown in Figure 3.4. Note that whilst Dettmer (2007) referred to the IO map in step 1, he relaunched it as the GT in (Dettmer 2011). The colour code (*red*) shows the specific TP tools that the researcher intended to apply in the context of this study. Further details of each of the proposed TP for this study is provided next.

While the individual tools could be listed under this sub-section, they are given their own sub-section number to reflect their relative status alongside the other systems thinking methods.

Figure 3.4: Link between the TOC-TPs & CQS (source: Mabin & Davies, 2013, Dettmer, 2007)

3.6.3.6 The goal tree (GT)

From a strategic perspective, every human-created system should have a goal that determines the direction and milestones against which it assesses its performance (Dettmer, 2003). Pretorius (2014) verbalises a central TOC tenet that we must think strategically by defining the system's goal and how it will be measured before starting to identify the systems constraints. The GT (Dettmer, 2011) induces such strategic thinking about the system by focusing our attention on, and requiring us to identify: Figure 3.5 shows the general format of a Goal Tree.

- ❖ The system's goal
- ❖ The critical success factors (CSFs)
- ❖ Necessary conditions (NCs) for that success

Figure 3.5: Structure of a Goal Tree (See Dettmer, 2003)

Although the GT was not originally part of the TOC-thinking process tools, it has been recognised for its importance in strategy development and analysis under the alternative term ‘strategic intermediate objectives map (S-IO) by Dettmer (2003).

A preliminary GT for the mining industry in Ghana (for completion after interactions with key stakeholders to understand from their perspectives) is attached (Appendix 8) that specifies the goal and CSFs, what the NCs must be to promote the CSFs and hence, the overall goal of the system. Once the GT has been defined, gaps in achievement of CSFs and NCs provide a rationale for answering the question ‘why change?’

3.6.3.7 Current reality tree (CRT)

One of the suggestions emerging from previous studies that is also critical for the purpose of this study is that of exploring root causes of key problems facing the mining industry in Ghana (Hilson et al., 2014). This can be possible through the use of the CRT.

Using sufficiency logic, the CRT is premised on the view that the ‘problems’ or ‘problem symptoms’ that we face in our daily lives as individuals or organisations are due to a few core problems that give rise to such symptoms (Cox & Schleier, 2010; Goldratt, 1994). It is only by identifying and addressing the hidden aspects of such problem symptoms that we are able to overcome or protect against the risk of resurgence of these symptoms (Ronen & Pass, 2008). The CRT is very useful for providing and adding structure to otherwise unstructured and ‘wicked’ problems (Walker & Cox, 2006).

By implication, using the CRT allows this study to probe into the deep-seated causes of significant problems and facilitates understanding of the nature and relationships of such problems. Such understanding is crucial for this study’s purpose and motivation, making analysis with the CRT a particularly useful tool for this study. A provisional CRT was developed for data collection (see Appendix 1) for details. The general structure of a CRT can be provided in Figure 3.6 as shown below.

3.6.3.8 The provisional CRT

Appendix 1 shows the structure of the CRT that was provisionally developed from the literature and used for data collection. This CRT later evolved following the field study and further analysis using the various analytical tools. The final version is considered later in Chapter 5 under section 5.6. To read or verbalise the CRT, we may start from the bottom-up and apply the sufficiency (‘If then’) logic. For example, the arc connecting the two arrow heads from (for example, the ‘*Root Cause*’) and Precondition (*A*) to the UDE in figure 3.6 above is often referred in TOC parlance as ‘banana’. What it means is that entity (*A*) alone is not sufficient to cause the effect (*UDE*).

It needs the other entity (i.e. the root cause in this case), to produce the effect and vice versa. Hence, to verbalise this, we say that: If (*A*)... and entity (*root cause*) then effect (*UDE*).

However, where the *root cause* is leading directly into the entity labelled (*Desirable Effect*) there is no banana, suggesting that entity (root cause) is sufficient to produce the effect. This relationship is therefore verbalised as: If entity (*Root Cause*) then entity (*Desirable Effect*). Typical examples of how to verbalised the CRT is provided later in Chapter 5 (section 5.6.1.1)

Figure 3.6: General structure of a CRT

3.6.3.9 Evaporating cloud (EC)

Oftentimes decision makers are confronted with tricky situations in which they are required to make a decision between two conflicting decision options that are (perceived to be) equally critical. The EC is designed to show how the conflict between the decision options can be resolved by firstly clearly stating the conflict making explicit the necessity relationships leading to the conflicting decision options, their underlying assumptions, before challenging these assumptions to produce a resolution. The approach facilitates sound decision making out of such complexity by focusing on the conflict and resolving it in a manner that enhances benefits throughout the system (Goldratt, 1990, 1994).

The EC uses necessity logic and a standard 5-box structure, shown in Figure 3.7 along with hints for how to construct it. The EC is then resolved by identifying actions that break the conflict, called ('injections'³¹)

Figure 3.7: The structure of an EC (Source: Cox, Mabin & Davies, 2005, p.44)

³¹ "Injection - A state, condition, or action that invalidates one or more assumptions underlying the relationships between the objective and requirements, or between requirements and prerequisites, or between the two prerequisites of an evaporating cloud" (TOCICO Dictionary, 2012, p. 66)

Detailed coverage of the key aspects of the EC, including how it could be verbalised is offered by Cox et al. (2005). In this study, the EC is used to devise solutions to several apparent conflicts giving rise to a multiplicity of issues facing the gold mining sector in Ghana. These help to offer practical alternatives that, when implemented, could bring longer-term improvements and benefits to stakeholders of the sector. The EC uses necessity logic (e.g. in order to A, we must have B) for the relationships between the 5 boxes, rather than cause-effect logic used in the reality trees.

The FRT is used for analysing cause-effect relationships from proposed actions leading to the desirable future, using sufficiency logic (Cox & Schleier, 2010). It allows testing of the viability of proposed injections from preceding phases of analysis to justify commitment or otherwise, of scarce resources (Dettmer, 1998). As illustrated in Figure 3.8 below, an FRT can help to test and understand the side effect of recommended solutions or injections for change from the EC prior to committing to implement such needed change(s).

Figure 3.8: The general structure of an FRT

As a central motivation, this study seeks to allow decision makers to act to improve outcomes from the mining industry in Ghana. Hence, the study concerns itself not only with understanding the key constraints limiting the industry's outcomes but also alternative actions that can transform the sector to a desired future, and effective management of the transition. This is what makes the FRT an important part of the analysis and the reason it would be utilised if time would be available to demonstrate its application. The negative branch reservation process would normally be used as part of the FRT development.

3.6.3.11 Prerequisite tree (PRT) frame

The PRT is a very useful implementation tool that follows the FRT. In the CQS discussed above, the CRT and EC construction clarify 'what to change'; the EC resolution and the FRT address 'what to change to' whilst the PRT and TRT address 'how to cause the change'. Indeed, some practitioners prefer to omit the PRT and advance to the Strategy and Tactics tree (S&T) directly. The novelty of the PRT as an implementation tool lies in its unique ability to facilitate successful implementation through development of intermediate objectives that overcome key obstacles (Cox & Schleier, 2010; Davies et al., 2005); the general structure of a PRT is provided in Figure 3.9. Whilst the PRT and GT result in similar diagrams and are both sometimes referred to as intermediate objective (IO) maps (Dettmer, 2003), the PRT is a more tactical implementation plan, whilst the GT lays out the high-level strategic imperatives for success and is best used in that context at the start of the problem-solving process.

Figure 3.9: The general structure of a PRT

For the purpose of exploring ways of improving outcomes from mining, this study aimed to demonstrate to stakeholders the strategic relevance of such complementary tools as the GT, CRT, EC, FRT and PRT. Together, these tools will provide valuable guidance for improving outcomes from the mining industry in Ghana.

The TOC TP tools discussed above are underpinned by a mix of sufficiency and necessary condition logics³² (Davies et al., 2005; Dettmer, 2007; Scheinkopf, 1999). Hence, analysing using such tools will help to capture cause-effect and necessary condition relationships that may exist in the mining system and enhance a better understanding of the sector.

3.7 Chapter Summary

The chapter has described the research approach, the study's ontological underpinnings based in critical realism, and an overview of the multi-framing approach. It has introduced each of the specific analytical frameworks, methods and tools that will be employed in the multi-framing analysis, which is operationalised in Chapter 5, at which time more detail on each method is provided.

In addition to the use of such methods to extract meaning, the field study discussions surfaced much other valuable information that provided background to the application of these analytical tools, and this is collated next in Chapter 4.

³² Sufficiency logic is read, "If "this"...then "that"" whilst necessary condition logic is read as: "In order to have "A"...we need "B"" (Mabin, Yee, Babington, Caldwell, & Moore, 2017, p. 3)

Chapter 4 : Information gleaned from the field study

4.1 Introduction

This study sought to address three main research questions in the quest to provide a platform for sound decision making about the gold mining industry in Ghana, to ultimately impact on improved outcomes and enhance the ability to maximise desirable benefits for key stakeholders of the sector. These research questions can be listed as follows:

- What is the nature, structure, and relationships that make up the gold mining industry in Ghana?
- How can decision-makers logically analyse (identify and understand), and address significant problems limiting desirable outcomes of the industry?
- What is the utility of a multi-framing approach in providing a platform for decision making and problem solving about the industry?

The first three chapters have reviewed and discussed available literature relevant to understanding the nature of the gold mining industry in Ghana. They have provided a summary of published data and literature on the industry and its place in Ghana's society and economy, and the results of studies published to date. It identified a selection of complementary frames, conceptual lenses and methodologies, set out to shed light on the systemic structures, relationships and issues faced by industry stakeholders in Ghana. The researcher sought to use these frameworks to develop an understanding to shed light on how aspects of endogenous and exogenous change may impact the sector at large and its various stakeholders.

This chapter builds on the prior sections and reports information gleaned from the fieldwork which may provide further insights for addressing the first question and lays a solid foundation for addressing the second question in Chapter 5 where the study operationalises the proposed multi-framing analytical approach. Thus, addressing the first research question above leads to insights for further analysis towards addressing the question of: how can we logically analyse, (identify and understand) and address significant problems limiting desirable outcomes of the industry?

It demonstrates the practicality, and the role of context in the multi-framing approach of Davies and Mabin (2001b) who recommend a need to take into consideration the role of context, and the nature of frames and the framing process. It approaches this by providing a voice and allowing the study to involve different stakeholders at different levels, focusing on different issues (in the social and fiscal environment) that impact on such stakeholders. By allowing the diversity of viewpoints of stakeholders to be involved and generating complementary insights from seeming conflict that may be inherent in disparate viewpoints in the socio-fiscal and supply chain (SC) context of the industry, the study will benefit from an understanding of significant issues limiting desirable outcomes for Ghana's stakeholders of the gold mining sector.

By understanding the issues limiting desirable outcomes for Ghana's stakeholders of the industry, this chapter will determine the appropriateness of the frameworks that make up the multi-framing analytical approach of this study and inform the multi-framing process or approach in Chapter 5 of the study. The chapter is structured to look at relevant viewpoints from the field study that shed light on three key aspects, namely: social, fiscal, and structural. The structural aspect is sub-divided to look at viewpoints that relate to the LSGM sector and ASSGM sub-sectors. The chapter concludes by highlighting key insights and learning thus far.

4.2 Exploring the natural and social environment of gold mining in Ghana

It is noted that gold mining can be economically beneficial and environmentally threatening, with adverse implications for human health and biodiversity loss. This section draws from information collected from the fieldwork for viewpoints that shed light on issues impacting on stakeholders within the social setting in which gold mining takes place in Ghana. Exploring the social setting could result in insights about the nature of relationships among key stakeholders particularly government, mining companies and mining communities. Such understanding may lead to relevant insights for consideration for change and improvement. The section is divided into two sub-sections looking at issues pertaining to the natural environment, and to management of social interactions.

4.2.1 Viewpoints that shed light on the natural environment

Four different viewpoints were surfaced from stakeholders during the fieldwork that shed light on issues concerning the management of the natural environment. Three of these viewpoints represent voices at the national level whilst the final one represents that of an industry expert.

4.2.1.1 Viewpoints surfaced at the national level: the ERSBA framework

The first instance of voice at the national level is about the framework for environmental regulation. It suggests a view that, following a lesson learned from environmental misconduct of a mining company in Ghana, the industry has taken necessary steps to safeguard the natural environment. It achieves this via a tighter regulatory environment built into the project approval process. Integrating environmental regulation into the project approval process means that any mining company investing in the industry contractually agrees and is proactively held accountable for sound management of the adverse impact of its activities.

*On that fateful day, **management of the company** came to the **EPA office** to discuss their intention to rehabilitate the areas affected by their activities.*

*During the discussions, they also said they did not have sufficient money to cover **the cost of rehabilitation** and suggested they would go offshore to get additional money. At the time the company's management was having these discussions with **EPA**, some of their management were also at the **Registrar General's Department** to **declare bankruptcy**, but the **EPA** had no clue.*

*The Registrar General's Department also **did not know what was happening at the EPA** because at that time, and even till today, we still do not have a common platform*

for sharing regulatory information, unlike other places where one regulator can enter information in one place, and it can be accessed everywhere by other regulators, and before a decision is made one can collate all relevant information on the system.

*Consequently, the company left without fulfilling its environmental obligation. When the news broke out, some civil society groups took the EPA to court. The government supported a proposal by EPA to **implement the environmental rehabilitation and security bond agreement (ERSBA)** to ensure strict environmental regulation and compliance. So now it is a must, and it is working very well. **Since then, the EPA ensured to implement the framework**, and we can say that the companies are doing their best environmentally [NL01]*

The above viewpoint implies that perhaps the gold mining industry in Ghana is less likely to constitute a threat to the natural environment and biodiversity or endanger human health which is desirable and noteworthy.

Nevertheless, this viewpoint also highlights the lack of a common platform linking regulators at various parts of the industry, which is a crucial challenge, reflecting the lack infrastructure for effective communication and information flow. Lack of effective communication and information flow can be considered a serious issue as this may translate to poor coordination of regulatory information. Through poor coordination of regulatory information, unnecessary delays, in regulatory processes are bound to occur. It may also slowdown monitoring and control activities of the regulator. This is not good for the industry, suggesting the need for frameworks that can help to address and improve on it.

Another viewpoint at the national level is about the decision chain of the environmental management system and sheds light on the multiple phases of impact assessments that precede the granting of environmental permits and other assessments undertaken during and after the project. Preceding the issuing of permits with an environmental and social impact assessments suggests the sector's recognition of the importance of due diligence in the environmental decision chain. Such recognition for due diligence reflects or reinforces the sector's commitment to safeguard the natural environment and minimise adverse impacts on society as was deduced from the viewpoint quoted earlier.

*Before the EPA issues environmental permit, we do environmental impact assessment (EIA). In the case of the large-scale gold mining sector, **we go straight away to the EIA**; it is the law. The components of the **EIA include scoping**, which is where the company and its consultants conduct **environmental impact analysis**.*

*The EPA also conducts its impact analyses, which [covers both] the **environmental and social impacts**. After the **scoping** the Company then completes the relevant **documentation and processing fees for environmental permit**. Then within the first **eighteen months of operations**, the company submits a **detailed environmental management plan for approval** and based on this, the company submits **monthly environmental reports**.*

*We also do our **monthly environmental assessments** as well, and others like the **Ghana Water Company** will be analysing nearby waters, air quality, and blast emission throughout the life of the mine.*

*Also, when the **company finishes operations and leaves the mine**, they are given **three years to take care of the liabilities**. And then if it is a reactive area, i.e. where there are **sulphuric materials**, they are given **about seven years to rehabilitate**. So that is just a rundown on the environmental management system of gold mining in Ghana [NL02]*

Complementing the above viewpoints, is a viewpoint illustrated below which sheds light on environmental pollution and environmental degradation. Like the viewpoints illustrated above, it suggests that the industry has achieved significant improvement regarding pollution related risks. Key among these pollution-related risks that have seen improvement are acid rainfall and absorption of acid content by edible fruits like oranges. Concerning degradation, this view suggests, despite the evidence for tighter regulation and compliance, the industry exposes the natural environment and key stakeholders (particularly government and mining communities) to risks associated with degradation.

*It is a fact, and that is mining for you. **The available technology is that you excavate, do blasting and all of that destroys biodiversity**. These are facts, and the impact on **human health too is also true** once you are destroying the environment. But then there are mitigation measures in place.*

*In those days, these companies used to do “**roasting**”. They roast the ore, especially the sulphuric ore, to convert it from sulphur to oxide and then release some SO₂ and CO₂ gases. These gases combined to give acid rain in places like Prestea and Bogoso where the ore is in sulphuric form, but not in Tarkwa where the ore is already in the oxide form and need not be converted.*

*But then some plants, like in Obuasi for example, orange trees absorbed arsenic trioxide and made them taste so sweet. **Now Obuasi orange is not sweet** because gold mining companies have transitioned **from roasting to using oxide plants or CIL** which is **an improvement in technology**, reducing the health risks.*

*But in terms of degradation, there is no question about that because when you mine, you are degrading the land. **We ensure rehabilitation is done but this can only be guaranteed for say, the tailings and waste rock dams**. When it comes to the pit itself, **we can’t guarantee it will be rehabilitated at all**. They can’t backfill it all because they have taken some materials out of the place and so **mathematically the equation will not balance**. So, **definitely some pits will be left**.*

But at the same time, remember Ghana’s revenue from gold mining is also increasing. So the more we increase revenue from gold mining, the more we increase environmental degradation. [NL03a]

It is noted from the above quote that there is a remarkable improvement in pollution-related risk as a result of the advancement in extraction and processing technologies. Similarly, there seems to be an acceptance about the lack of alternatives to excavation which makes degradation inevitable. This consideration characterises the gold mining industry in a manner that reflect the sector's acceptance of environmental issues and reliance on technology solutions. Such issues constitute

biodiversity and human health risks and may benefit from being analysed using an EC approach. In this regard, the key conflict will be whether to rely on technology solution to the degradation challenge or otherwise. How to approach such situations will be demonstrated later in Chapter 5.

4.2.1.2 Viewpoint of an industry expert

In addition to the viewpoints discussed above which represent the voice of stakeholders at the national level, the view of an industry expert was also sought and as shown below, this view pointed to gold mining in forest reserves. This viewpoint reflects on the need to preserve safeguard the forest on the one hand, and the need to mine the gold on the other hand and asks critical questions concerning how the industry could mine the gold without destroying the forest. This suggests an awareness by environmental regulators and policy decision-makers of the complexity embedded in gold mining in forest reserves.

*We have a large deposit of gold in forest reserves in Ghana. We need to preserve the forest, but we need to mine the gold as well. We asked the question; **how do we mine without compromising the need to preserve the forest for the future?** Out of about seventeen companies that had expressed interest to mine in forest reserves at the time, we selected only 5 for trial.*

*And then what we did was to **set up other guidelines for mining in the forest**. So, for example, if the gold occurs in a forest reserve, we know that we can only mine the gold where it occurs so there is nothing we can do about that one.*

Except for the pit, which we allow the companies to construct in the forest, we do not allow them to have offices/workshops in the forest as one of the principal guidelines.

*Also, **for every acre mined, a company is required to offset it by providing three times somewhere else, which means providing a new forest three times the size of the original during reclamation to compensate for every acre of the original forest mined** [IE01a]*

This quote indicates the sense of recognition by regulators for the need for other regulatory guidelines beyond the boundary of the ERSBA in seeking to mine the gold without compromising the forest.

However, we may also need to consider a view that meeting such regulatory requirements may only legitimate the activities of mining companies but not necessarily address the complexity embedded in mining in forest reserves. By legitimating mining activities in forest reserves without addressing the complexity, regulators may be supervising the destruction of natural habitats, loss of biodiversity, and endangering the health and wellbeing of mining communities.

A suitable solution to this challenge could be provided by embracing frameworks that may help to capture and manage possible conflict that underlies the complexity embedded in the issue of mining in forest reserves. It is therefore essential for the multi-framing approach to involve frameworks that may help to provide a suitable solution to issues such as mining in forest reserves which seem to present a managerial challenge for environmental regulators.

Concerning the issue of mining in forest reserves, we may reframe the question of how do we mine without compromising the forest, to incorporate the needs of future generations. In other words, how do we mine in the forest reserves to meet present needs without compromising the ability of future generations to meet their needs?

4.2.2 Viewpoints that shed light on the natural and social environment

Seven viewpoints are considered in this section, providing a voice to a range of stakeholders at various levels (including firm, national and community) and an industry expert. These viewpoints shed light on the management of compensations in mining communities by the industry. It also sheds light on the nature of corporate social responsibility as an aspect that seems to be regarded by some scholars as providing a firm-level solution to key issues that surface at the community level (Mireku-Gyimah & Gyamfi, 2016), and as a more effective alternative for addressing developmental concerns at the national level (Larsen et al., 2009).

By complementing insights generated from the diversity of viewpoints of stakeholders about the notion of compensation and CSR, we may improve our understanding of the social context in which gold mining takes place in Ghana. The resulting knowledge and understanding generated could then lead to insights for further analysis and consideration for change and improvement to ultimately benefit stakeholders.

Two of the viewpoints covered in this sub-section are about the nature of the compensation scheme while five of them provide information about CSR.

4.2.2.1 A firm-level viewpoint on compensations in mining communities

As shown below, a firm-level view is about the nature of the scheme, which involves monetary compensation and relocation of members of a mining community whose sources of livelihood, including homes, are considered to be adversely affected or could possibly be affected by the activities of a mining project. It also sheds light about the administration, highlighting the reasoning taken into consideration in determining, for example, how much to compensate a farmer for an affected cocoa farm based on an equivalent yield per cocoa tree over a reasonable number of years which is noteworthy.

*We do a scientific calculation to determine the amount to pay. For instance, if we are taking over a cocoa farm, we assume that a **cocoa** tree can yield fruits for the **farmer for the next, say 20 years** at a specific rate which is determined by the government for any affected source of **livelihood**, including the **cocoa tree**.*

We use this compensation rate as the basis to determine the amount to compensate an affected cocoa farmer. So that is what goes into compensation for a cocoa farm that is affected. We also compensate for any property that is affected.

*So, if houses are affected, we will build similar homes elsewhere, even better ones and relocate those affected. **It means if a 10-room house is affected**, we will build a 10-room house with blocks even if the affected one **were a mud house**. Some of the people, including the natives and some residents, may decide to **relocate to other destinations**.*

*In this case, they may opt for **monetary compensation** or sell the house and use the money for something else. The most important thing is that we do not just get up to start mining the gold; we compensate for everything.*

At least there is a discussion that goes on before as well [FL01]

It may also be drawn from the firm-level viewpoint to highlight the pertinent issue of relocation of some members of mining communities (both indigenous and residents) to establish themselves and their families, perhaps in the cities, as a direct consequence of the sector's activities. This rural-urban movement could have implications that may include depriving or delaying infrastructural development of mining communities, as such members (possibly the elite members) may end up investing in a business or pursue developmental projects in the cities. It may cause the destruction of the social community as well if people relocate to cities. Consequently, we may say that while community livelihood compensation is crucial, it has other side effects that may be undesirable, suggesting it could be improved.

4.2.2.2 A national-level view on compensation in mining communities

As illustrated below, a national level viewpoint is about limitation(s) of the community livelihood compensation (CLC), reflecting a lack of equitable distribution of benefit to stakeholders of mining communities. It suggests that some group of stakeholders benefit from the compensation scheme more than others which is a crucial concern, and a need to be rectified.

*The **land tenure system** here is different; most of the **natives** are not farmers themselves. They may have **leased** their land on '**abunu**' or '**abusa**' basis, to a **resident farmer** who may not be a native member of the community.*

When a mining company arrives, usually government acquire the land through the state as a concession and assign it to the mining company.

*The mining company must, by law, **compensate the people occupying the land** who may be affected by the project. Here is the case the land may have been leased on '**abunu**' or '**abusa**' to the occupant by the owner of the land, mostly the chief.*

*This **occupant** may have also **shared the same land with a tenant farmer** on the same basis, making it a **complicated chain**.*

*In this case, as the **company compensate the occupant farmer**, he or she must also **compensate the owner of the land**. The **tenant farmer** is often **not taken care of** by the **occupant**.*

*As a result, **the livelihood chain breaks** that is a **key challenge we are facing as regulators**. It is a grey area we have not been able to tackle [NL03b]*

This national-level view also suggests a desire for decision-makers to address this challenge and strengthen the livelihood chain. Also, we may draw from the illustrative quote above that decision-makers of the industry are of the view that perhaps the land tenure system of Ghana could be responsible for the lack of equitable distribution of benefit from the CLC. Perhaps by subjecting this issue to further analysis using appropriate frameworks that make up the multi-framing

approach of this study, we may likely get to the bottom of this issue and provide helpful information to guide suitable solution to the problem.

Other viewpoints from the fieldwork relate to the use of CSR as a firm-level approach. We consider five relevant viewpoints on CSR as follows.

4.2.2.3 A firm-level viewpoint on CSR versus loss of livelihood through job redundancy

One instance of a firm-level voice reflects the intent of mining companies to contribute to community development and impact on the lives through maintaining a culture of CSR. It additionally reflects a view or recognition by mining companies that CSR as a collective effort of stakeholders is required to improve benefit from gold mining for stakeholders without constraining the ability of such companies to focus on the business goals.

*We have in our **values** that **communities** and **societies** in which we **operate** would be **better off**. So, whatever we do, our aim is to improve communities and the lives of the people. But we **cannot** put all our **resource** into **developing communities**.*

*We are **constructing roads** and **building schools** and **hospitals** in some of the communities. There is a **budget limit** to which we can do all these things.*

*So, we ask for **support** in the form of **mine stability agreement** with the **government**. It comes with **additional responsibility** we ensure to fulfil them.*

*However, there is a **wrong perception** out there by the people, including **politicians** who have no idea about the **terms** and **conditions** of the stability agreement, that mining companies are not doing enough for the communities.*

*Let us say political part A loses in an election, and a political party B comes to power, for instance, **someone** now appears and say she or he is **minister** this or that and start **throwing political shots** at us but may not know the terms and conditions of the agreement.*

*So, **companies are doing the best we can**, but we also need to be able to **appropriately apportion** what the **company's requirements** are, and what **government responsibilities** are if we want to **improve benefits for all** [FL02]*

This view additionally reflects a belief that government support in the form of a mine stability agreement has the potential to help mining companies to manage the balance between focusing on the business goals and improving mining communities through CSR.

4.2.2.3.1 A firm-level viewpoint in defence for job redundancy

Another instance of a firm-level viewpoint is as illustrated as follows. It highlights the issue of job redundancy as "a common managerial phenomenon" of the industry. It underscores the value of government support in the form of a mine stability agreement to remedy this undesirable situation.

*It is a common managerial phenomenon. **If we hesitate** to do that **when it is required**, we may **kill the company**; but if we do that then we give the company a **chance to survive** when it is a **lean season of the industry**.*

*The **logic of redundancy** is to survive when we **cannot make it** and when we have **extra hands doing no job**.*

*It means that **if the business is booming**, we may **need extra hands** and if the business is **struggling** as a result of a **fall in gold prices** and we cannot make it and all that we have got is to **reduce factors of production** then we have to do it **for survival**.*

*After all, in the **capitalist economic model**, factors of production **must be engaged**. So **factors of production are not relevant if they are not engaged**.*

*But if the **government** says listen, keep your staff, I will **pay a fraction of your salary** within this space then why not. Most companies have been able to keep a reasonable number of people in a job because the government is paying some salaries. We are not referring to gold mining in Ghana per se.*

We are talking about what takes place in other parts of the world. At a point in time, Philips wanted to relocate, and the Dutch government said listen, people would lose jobs. So, they had the stability kind of arrangement where the government was paying top-up to support Philips to stay.

In America, it is the same thing that President Trump is practically preaching, and in the early days of Obama, that is what he also did [FL03]

Aside from attributing the issue of job redundancy to lack of government support in challenging situations of the industry, the sector's belief in the traditional logic of management is also quite evident. Such a belief in the traditional logic also reflects a view that mining companies prioritise the business goal, suggesting an implied lack of a win-win environment and raises the question of whether or not the government should encourage the use of a mine stability agreement at all. Addressing this type of questions is thus, necessary and hence, in the multi-framing analysis chapter of this study, we may provide frameworks to guide how to approach such question.

4.2.2.3.2 A firm-level viewpoint that reflects a balanced critique of the current situation

Moreover, another perspective of a firm-level viewpoint is as shown below, which provides a more balanced critique of mining companies and mining communities in a manner that characterises these stakeholders as to constitute part of the problem'. For example, it characterises mining communities as making vague or imprecise demands that can be challenging for mining companies to meet, and this is another major issue of concern that may need attention.

*Indeed, **their expectations** are quite **difficult to measure** because maybe **today they want a 'good' school**; **tomorrow they want a 'good' hospital**; the **other day they wanted jobs**.*

*On the other hand, it is **hard to understand** why **we still transport people to work daily**. It does not even make economic sense.*

*They should come to stay here. And **if they come to stay**, the **communities around will see a facelift** [FL04]*

Nevertheless, the above quote criticises mining companies for not taking advantage of opportunities from the sector's operations such as the daily transport of staff 'in and out' of work

that has the potential to add value to mining communities if the industry makes the right decisions about them. The concern about transporting staff in and out of work translates to concern about the workforce's decision. Such concern then suggests an implied need to guide stakeholders throughout the sector to make the right decisions.

Complementing the views attributed solely to the firm level, as discussed above, the perspectives of an industry expert and stakeholders at the community level are as follows.

4.2.2.4 An industry expert view about CSR

In contrast to the firm's view above, an industry expert seems to provide an independent critique of CSR of the industry in a manner that suggests the government is insensitive to its responsibilities and what constitutes the ultimate goal of mining companies in Ghana.

*The failure is from the government. For example, we are receiving royalties and other taxes from these companies. So, the government should **not expect them to be building schools and other infrastructure, which are its responsibility.***

*These companies go to the extent of building schools and other projects which they should not be doing. One of the mining companies is **putting up a police training college** in one of the communities. Just visit **any mining community**, and there is **something to see in terms of the impact.***

*So, the companies are doing their best. They have what they call the **community-company consultative committee**, and this committee meets at least every quarter to discuss whatever issues they may have.*

*And then **some of our chiefs are not good.** Some of them **only think about their pockets** when they get the **community share of the mining development fund.***

*Look at the roadblock in Tarkwa for instance; the **people are complaining** that the mining companies are **not improving the road.***

*Meanwhile, there is a road from Tarkwa to Wassa Damang, which has recently been **improved to asphalt** by one of the companies operating in that area. The politicians around are **taking credit for themselves**; we must know that **these companies are here to do their business; not to construct roads.***

*But **some companies also have tax relief and arrangements with the government**, and some **mining equipment are also exempted from payment of import duties and all that** [IE01b]*

As highlighted above, the industry expert seems to endorse the view emanating from the firm-level regarding the limited use of a mine stability agreement, expressing this as 'some companies have some tax relief and arrangements with government'. Limiting the use of mine stability agreement implies that mining companies who have no access to a mine stability agreement with the government may not benefit from tax relief that is available to other mining companies.

Nevertheless, public perception, particularly stakeholders at the community level, may unknowingly hold mining companies to the same level of expectations and demands when it comes

to CSR. Such public perceptions have implications that may give an unfair advantage to companies who benefit from the use of a mine stability agreement compared to those who have no access to such support from the government.

4.2.2.5 A community-level viewpoint about CSR

Unlike the view of the industry expert discussed above, whose critique seems to support or favour firms and blames the government for shortcomings, a community-level voice expresses concern about both mining companies and government as least proactive in responding to their needs and demands until drastic actions have been taken.

Beyond concerns about livelihood issues and poor infrastructural development, mining communities are also seriously concerned about the lack of a formal document or agreement such as an MOU [memorandum of understanding] to govern their relationship with mining companies to guarantee their commitment and support for such companies.

*Sometimes we **don't even know whether the government is involved**. Because, if the government is involved, let us say we **need a school building or other facilities**, at least we should **see government officials in the community**, but we **do not see them**.*

*All the time if we are **complaining about livelihood issues and others**, the **Agric (Agricultural) officers**, or **Ministry of Trade and Industry** is not coming here.*

*When we go to the **district**, the **Works Department** is not coming here even to ask or assess what are the things that we lack in our communities.*

***We don't see the proactiveness of the government here at all**. They wait for us to cry out or **raise a red flag before the government comes in**.*

Moreover, we don't even have an MOU to guide our relationship with the mining company. So we make a request and the company may either respond to it or not.

Then we demonstrate before the government decides to act.

So the communities and government should come together and bring the mining companies on board so that we all discuss and know the way forward and how best to get there [CL01]

The above issues and concerns of mining communities seem to indicate the existence of arms-length relationship among government, mining companies and mining communities despite an espoused interest by the industry to minimise adverse consequence or maximise the benefit for such stakeholders.

The key questions thus are whether the government should encourage the use of mine stability agreements in general to make it accessible by all companies, or whether they should be encouraged at all in the gold mining industry in Ghana?

4.3 Exploring the fiscal environment of gold mining in Ghana

Gold mining can be economically beneficial if managed, despite it also having noticeable side effects that are undesirable. Building on the previous section which shed light on the nature of relationships from the context of a social environment, this section seeks to understand the dynamic relationship between government and mining companies in the context of the fiscal environment. Specifically, it focuses on fiscal policies that the government uses to manage or maximise Ghana's revenue from the gold mining sector. Focusing on government fiscal policies can inform understanding about cause-effect relationships and help offered and can be applied to characterise the dynamic relationships between government and mining companies. Hence, in this section, reference will be made to 'fiscal framework' for discussion purposes where necessary.

4.3.1 Viewpoints that shed light on the fiscal environment

There are three viewpoints from the fieldwork that shed light on the fiscal environment. One of these viewpoints is from the firm level and contributes insights about a 15% VAT on exploration and a related policy that looks like ring-fencing. The remaining viewpoints are from the national level and contribute complementary insights and recommendations that are relevant for understanding the fiscal environment.

Starting from the firm level, we report these viewpoints as follows.

4.3.3.1 A firm-level viewpoint about the fiscal environment

As indicated earlier and illustrated below, a firm-level view is about a 15% VAT charges on exploration as aspects and the associated policy reflecting as the ring-fencing mining projects as policies which mining companies are concerned about although these may be maximising Ghana's revenues to the industry.

There are some policies such as VAT on exploration, which is discouraging exploration activities. It is just like killing the goose that lays the golden egg.

What makes it wrong is the fact that doing exploration is like sinking money on the ground, the outcome is unpredictable. It is very discouraging, to be honest.

It is like asking someone to pay 15% VAT on a dead body.

Apart from the 15% VAT, if the company has multiple projects like ours, for example, each of them must pay its taxes.

The problem is that if a company starts a new project, it means it is going to pay 15% VAT on exploration, and then in case the new project makes losses, the law does not allow us to transfer such losses to the other project to reduce the tax burden.

With so much uncertainties surrounding our operations, it is difficult to start a new project because we have no idea whether that project can produce enough to be profitable [FL05]

As reflected in the illustrated quote above, this view questions the appropriateness about charging 15% VAT on exploration of each individual project as an aspect of the sector's activities that seems

to constitute a significant source of investment risks with implications for the industry as a whole as it discourages exploration efforts. It implies that policies such as charging VAT on exploration activities and ring-fencing of projects makes it impossible to offset investment risks with gains from other projects.

Such fiscal policies may favour the government in terms of helping to maximise revenues to the state, and safeguard Ghana's fiscal contribution linked to gold mining supply and value chain from leakages through corporate misconduct as of the main challenges affecting most mineral resource-rich African countries (Pieth, 2018). Additionally, the activities of such worldwide bodies as the Organisation for Economic Co-operation and Development (OECD), the UN, IFC and the World Bank about corporate misconduct are increasing in awareness, recognition and impact.

For or example, the activities of the OECD the awareness created by the G20 base erosion and profit shifting campaign as part of the activities the OECD seems to have had a significant impact on governments of most mineral resource-rich developing countries like Ghana, become more aggressive with their fiscal policies than before. Thus, the use of such fiscal policies as the ring-fencing of projects, and the 15% VAT charges reflect an awareness by the government of Ghana about issues of corporate misconduct that could be linked among other things, to knowledge from such activities as the G20 campaigns.

It has also emphatically pointed out that Ghana's ability to maximise revenues to the state is constrain by (sic) a systemic under-devaluation of royalties and profits by multinational large-scale mining companies. Such issues and how it intends to respond using aggressive fiscal strategies are captured in the 2019 budget statement of the Republic of (Government of Ghana, 2019, p. 120), Key amongst these strategies as captured in the document include:

- ❖ Ensuring greater scrutiny of the quantity and quality of minerals produced in Ghana as the basis of revenue determination and export valuation
- ❖ Curbing base erosion as a source of systematic under-devaluation of royalties and profits
- ❖ Tightening the regime that governs foreign exchange repatriation through the Bank of Ghana,
- ❖ Capitalising Tax Expenditures (Exemptions) and recognising them as additional government equity holdings in mining companies; and
- ❖ Revitalising the Inter-Agency Technical Committee on Mining

Thus, the use of such policies as ring-fencing, and the charging of a 15% VAT clearly reflect the government's intentions to protect its interest from the gold mining industry in Ghana through aggressive strategies as highlighted above.

But on the other hand, the use of such aggressive strategies can make it more challenging for mining companies to achieve their business goals, and come with implications that may limit the ability of Ghana to maximise overall benefit of the gold mining industry Thus, the use of aggressive strategies could contribute to the design and use of an ineffective fiscal framework and

constrain the profitability of operating companies and hence, hold back the attractiveness of the gold mining industry in Ghana to investment Eshun (2018). Also, in his doctoral thesis Atta (2019) also implies that when mining companies lack cost competitiveness, Ghana's benefit through the employment the potential associated with the sector is adversely affected as more (more) gainfully employed Ghanaians lose their jobs through severance or redundancy exercises promoted by such companies. This confirms one of the viewpoints surfaced at the firm level of this study which seems to have a business case justification for the logic of employee redundancy as necessary for survival particularly during lean seasons of the industry.

In summary, the above concerns reflect a view that the fiscal environment of gold mining in Ghana distorts investment and operational decisions of mining companies and make it less attractive for investment. Perhaps, by subjecting the above concerns to further analysis, it may be possible to reach a better understanding of whether such fiscal policies should be encouraged and whether other alternatives may help.

4.3.3.2 A national-level viewpoint on the fiscal environment

One perspective of a national-level viewpoint concerning the fiscal environment suggests a need for the government to recognise and reward investment risks more appropriately. As illustrated below, this viewpoint considers investment in exploration is a significant risk with a higher rate of failure globally and does not guarantee a return on investment. It also suggests an alternative view that the government should consider complementing the effort of mining companies by sharing investment risks if it seeks to maximise its benefit from the sector as this viewpoint additionally suggests.

The success rate of gold projects is between 3 and 5 per cent. That is the success rate globally, meaning a company can lose big. So, if companies take the risk, then they should be rewarded.

Of course, companies can also win big if the project is successful. So, if we want to gain more as a country, then the government must be prepared to share the investment risks with the mining companies. Also, when investors express an interest to invest, we need to negotiate for a win-win.

We must ensure to calculate all the risks involved and share accordingly. The companies that invest in the industry are multinationals. They have access to information about the industry than we have as a country which makes them more powerful than us.

It is not only in gold mining but the extractive industry in general, which includes the oil and gas sectors.

Ghana lacks people who are well-trained to negotiate for a win-win outcome for the country [NL04]

Thus, this view emphasises a need for government and mining companies to negotiate to achieve a win-win outcome. However, it also recognises or suggests that the government lacks enough detailed knowledge and information required to negotiate effectively due to mining companies

having better industry or business knowledge and information. The resulting negotiation gap, as this viewpoint implies, makes a win-win outcome impossible, suggesting a need for a better approach that can bridge this gap or overcome the risks.

Moreover, another perspective of a national level viewpoint illustrated below touches on an even more critical issue. It suggests that whilst some companies are yet to realise a profit on their investment, others may deliberately fail to declare a profit, reflecting an implied situation of tax avoidance as a countermeasure in response to the constraining fiscal environment.

It is a general refrain!

*You will get **government** saying that we **don't get enough** from the **mining companies**; you have the **community members** also saying the mining operations are **not impacting our lives** as we **expected**; and then you will hear companies also saying that the **cost environment** is too high for us and as a result we are also **unable to make profits in this country** and that we are **less competitive** when we operate in Ghana relative to... then they will mention a number of countries for you.*

*We **have some mining companies** that have **not made a profit over several years**, and they are **still operating** with the hope that they will be able to **make that turn**.*

*There are **companies too** that **usually do not declare a profit**, and they **make a profit right**, but they **do not declare dividends** because they instead **want to plough back the profit into their business**.*

Ploughing back the profit saves them from borrowing from the financial market and the cost associated with it.

*So, it makes sense for the company to **retain portions of its profits or all of its profits, inject it into the business** and then when it has achieved its objectives, it can start paying out profit [NL05]*

Considering the issue of fiscal policies discussed above, the impact on mining companies and the countermeasures revealed through the ongoing discussions; we may consider or more appropriately characterise the relationship between government and mining companies to be that of a win-lose in the context of the fiscal environment. Such a win-lose relationship can make it more challenging for the industry to achieve desired outcomes or maximise the benefit for these stakeholders, suggesting a need for improvement.

The above issues lead to the two essential questions that may need attention and consideration are: whether the government should discontinue the 15% VAT charges on exploration and ring-fencing of projects or otherwise?

4.4 Viewpoints that shed light on the industry structure

This section is divided to look at relevant viewpoints that shed light on issues affecting the industry as a whole, and other issues that are specific to the ASSGM sub-sector. Exploring relevant issues relating to the industry structure under these separate headings is important, reflecting the LSGM-ASSGM gap that characterises the industry in the first place. Secondly, exploring viewpoints under

these two headings is also important to enable understanding of structural issues that are specific to the industry as a whole, and those that relate specifically to the ASSGM sub-sector to be highlighted. Based on such specifics, appropriate recommendations could be made for tailored actions where necessary. The section covers nine viewpoints overall. As shown below, the first four relates to the structural issues at the industry level (LSGM sector) whilst the remaining five also concerns the ASSGM sector.

4.4.1 Viewpoints that relate to the industry as a whole

As indicated, this section will cover four of nine viewpoints from the fieldwork. Two of these viewpoints are from the national level; one of them is about the underlying framework for value creation which is export-driven whilst the other viewpoints share complementary information about the gold value chain in Ghana.

A viewpoint surfaced at the firm level sheds light on an undesirable effect of dependence on overseas suppliers. A final viewpoint, by an industry expert, contributes complementary insights with examples of industries that have collapsed because of dependence on overseas suppliers.

4.4.1.1 National-level viewpoint: industry is export-driven

The first national-level viewpoint concerns the nature of the framework for value creation which is export driven. This view suggests that whilst some benefits have been realised by focusing on the export potential, the approach has also created room for significant leakages of value out of the Ghanaian economy which benefit overseas actors.

*How we have developed our gold mining sector is not different from how the forerunners of the industry, our **colonial authorities**, ran the industry. The **purpose** was just to **produce the ore here, ship it abroad**, and then they will **add the value to it externally**.*

*The **Queen** was in control of Ghana, all the assets in the country belonged to her. So, what they did then was they mined the gold ore in Ghana, **exported raw gold out of the country, added value to it and paid a royalty to the Queen** because she was the owner of the resources at the time.*

*Of course, the government at the time also **used part of the revenue realised to develop the country**, in those days, the Gold Coast. We can point to **Kele-bu Teaching Hospital** and the Achimota Hospital as typical examples.*

*The point here is that the **model that we inherited from the colonial period is what we are following**. **We have not decided to change the model**. For instance, we mine in the country and export everything and import most of the inputs.*

*What will **remain** in our country **are few services** that some of our **local businesses** can provide, the **taxes that the government can collect**, and the **salaries paid to employees**.*

*The **chunk of the money will dissipate** or leave the country **through the importation of inputs, and exportation of output and significant profits are also repatriated** [NL06]*

By implication, the above view seems to suggest that for Ghana to benefit from the full potential of its gold mining sector, there is the need to change from being export driven. Hence, it questions whether the export-driven model (based on exploitive power relations) as a colonial legacy could be appropriate for the industry.

4.4.1.2 National-level viewpoint: the gold value chain

The second national-level viewpoint concerns the value chain as illustrated below.

*We buy about (2 to 3) kg of gold every month from **small-scale miners** to make jewellery to sell to the public. We **import 10%** of our jewellery twice a year. Some of our customers need them.*

*The rest [90%] is **produced here in Ghana by us**. We sell a standard gold ring of **10gram 18 karat gold** to customers at **Ghc 3,950** and that of a **10gram, 22 karats** at **Ghc 5,200**.*

We face competition from importers of sub-standard gold products from China. Some of these importers visit our showroom to copy our designs, but we cannot tell who a customer is and who is not.

*They sell **sub-standard jewellery**, so their **prices** are **way lower** and that makes us look **more expensive**.*

***Government** needs to **put restrictive measures on the importation of gold products into the country** to support us.*

*We also need to **prioritise local consumption of gold as a country** [NL07]*

The above statistics provided by a senior executive at an official source represent an amount of gold used for making gold jewellery by this recognised mining body in Ghana [name withheld in compliance with ethical requirements]. This topic is revisited in Chapter 6 discussing the amounts of gold consumed locally versus gold exported.

4.4.1.3 A firm-level viewpoint: industry depends increasingly more on overseas suppliers

The first firm-level viewpoint expresses concern about dependence on overseas suppliers for supplying of most mining inputs and attributes this situation to the lack of capability of local suppliers to meet the requirement of mining companies locally without relying on overseas suppliers and constitute a concern.

*In terms of statistics, about **90% of materials** are **bought from overseas** and about **10% from local sources**.*

*We are **not benefiting much from the sector**, and the reason is that our **local suppliers** **rely on overseas suppliers**.*

*So the **10%** we source from local suppliers **end up coming from overseas** because we have **not developed the capacity** of our **local supply chains** to **independently supply** most inputs required by the gold industry locally [FL06]*

The issue of dependence on overseas suppliers and the associated concern about the lack of development of local capacity may lead to other consequential risks or implications, as is echoed by an industry expert below.

4.4.1.4 An industry expert viewpoint: local industries and their supply chains are collapsing

Echoing the firm-level view above, an industry expert contributed insights relevant for understanding the risk implication for dependence on overseas suppliers or lack of development of local capacity. This industry expert provided the collapse of specific local industries associated with the gold mining industry in Ghana, namely The Firestone Tyre Manufacturing Company and a gold refinery in Ghana, as typical examples that may provide a useful basis for analysing the associated risks.

*Go to Tarkwa and you will be surprised to find that the **gold refinery** that was built by Dr Kwame Nkrumah is **abandoned and left to rot**. It has now **become a student hostel**. All the machines are left to rot.*

*There used to be a **company that produced Firestone Tyres**. Now Firestone is no longer produced in Ghana. As long as people are increasingly importing vehicles into the country, tyres will be needed.*

*Yet a company like that is left to rot? **We are talking about a factory which had got about 80% of the raw material in the country**. When Dr Kwame Nkrumah established the tyre factory, he additionally established **rubber plantations as a source of raw material**.*

*We have **sold most of these rubber farms to GREL** following **the collapse of the [Firestone] Tyre Company**. At least if not **machine tyres, light vehicle tyres** were being produced in Ghana, and that is where we were all bought our vehicle tyres from.*

*But now all **tyres are imported from overseas**. So, we have to **revive abandoned companies that have a link to the industry**, especially **those that do not depend on gold for raw materials such as the Firestone Tyres**.*

Probably the technology has changed, and so we may have to catch up, but it will not be like starting afresh [IE01c]

Consequently, the collapse of the local gold refinery in Tarkwa, for example, may directly translate to a reduction in local refinery capacity to undertake value-adding gold refinery activities in Ghana which may have adverse impacts (particularly) on forward linkages if not addressed.

Similarly, the collapse of a company like a Firestone Tyre manufacturing may adversely affect the development of upstream economic activities linked linking the tyre supply chain. Unlike the gold refinery, which may affect the forward linkages, the collapse of the Firestone Tyre company has the potential to adversely affect backwards linkages.

The critical question emanating from the issues and concerns discussed in this section is: whether the industry should change or maintain the export-driven model underlying value creation for its stakeholders?

4.4.2 Viewpoints specific to ASSGM sub-sector

This sub-section draws information from five viewpoints relevant for improving understanding of how the ASSGM sector operates and reveals some of the main structural issues affecting the ASSGM sector in Ghana. It starts with a viewpoint surfaced from an industry expert which provides suggestions and recommendations for improving the ASSGM sector. A national-level viewpoint that follows highlights some challenges and concerns, including foreign participation and the impacts and risks.

The remaining three are from the community level and provide a voice to ASSGM operators wishing to transition to LSGM operations; ASSGM operations in the rudimentary form of Galamsey; and finally, licensed gold buyers operating in the artisanal gold market in Ghana.

4.4.2.1 An industry expert viewpoint: recommendations for change

As indicated earlier, this section starts by considering the viewpoint of an industry expert, reflecting suggestions or recommendations for change and improvement as illustrated below. This industry expert considered the ASSGM sector could perhaps be formalised or improved by transitioning from a focus on small-scale to medium-scale operation; or from individual operations to group-based or partnership models such as cooperatives and LSGM-ASSGM collaborations.

*During our time, it used to be **artisanal mining**. In those days they used **shovels** and **pickaxes**, but now they say it is **small-scale**, and they are using **excavators** and all that, so in about 2 to 3 days **25 acres are gone**.*

*In the Philippines, they faced similar problems like us, but they do not focus so much on small-scale mining. They do what we call **cooperative mining**. So about 5 to 7 or more people will come together to get, say 250 acres for a **medium-scale mine**.*

Instead of small-scale, we should think of medium-scale mining. We also have the tributer system, and that is what was in the law.

[As an example], we had a deposit that we could not operate for financial reasons.

*At that time, we saw that the **artisanal miners were encroaching**. Instead of chasing them away, **we assisted them in working and shared the benefit**. The **mine took 50%** and **gave them 50%** of whatever we made at the end of the day, and it worked well.*

*We **worked as partners**, so at the end of operations, they **brought the concentrate** to the mine then **we processed and extracted the gold**. However, we also made sure to **put our security there to supervise them**.*

*Even today, there are **some concessions where the large-scale mining companies may never mine** because they may **not be profitable** from a large-scale operational perspective.*

*They can enter into **the tributer kind of arrangement** with the artisanal sector and get the concentrate from them for processing [IE01d]*

The industry expert also highlights the potential value that factors such as a win-win environment, possibly using a collaborative-based concept like a 'Tributer System', to facilitate formalisation. Another critical success factor, as the industry expert implies, is to ensure effective monitoring and control despite establishing a mutually-beneficial relationship.

The above suggestions and recommendations for change and improvement are noteworthy for further consideration and analysis.

4.4.2.2 A national-level viewpoint: 'aggressive' mechanisation of ASSGM sector

Meanwhile, a national-level viewpoint shed light about foreign involvement, mechanisation and the adverse impact that illegalities associated with the sector is having on stakeholders of the industry, including the natural environment, government and the wider society. Thus, we may call this type of ASSGM organisation as mechanised illegal (or 'aggressive') ASSGM.

This national-level view additionally expresses concern about the ultimate objectives and purpose of reserving the ASSGM sector solely for investment by Ghanaians, which is to address poverty in Ghana. Considering the issues and concerns surfaced from the national level as illustrated below, the ASSGM sector seems to constitute a significant challenge to the industry and hence, may worth the effort of subjecting the sector to further analysis to surface ideas for improvement.

*The whole idea behind the artisanal and small-scale gold mining sector was to **drive down poverty**. But the **reality is that it is not**, because **few people are benefiting**. The **rich man takes the concession, brings in the Chinese**, then the mine the gold, **take the money away and the local people come to labour there just for peanuts**.*

*Their **activities** create **environmental problems** for the **government** and **compete** with **farming** which is the main source of revenue for the local people.*

*It will interest you to know that most farmers are even willing and ready to give their cocoa farms away in **exchange for the gold money**. The law says **that it is strictly for Ghanaians**. But the **Chinese** come and **team up with Ghanaians** to get the concessions.*

*But then there is also **another aspect of the law about service support**, so **they come** under service support which is also **permitted under the law**. But then it is also about **Ghanaian citizens**, whether they will be able to **raise the initial capital** to buy the **machinery** and that is what the **Chinese capitalise on**.*

*And some or even most of them [Chinese] have gone on their own to **team up with chiefs** and then **acquire lands**. You see, these are illegal issues that is why **Vanguard**³³ came in.*

The sector is no longer artisanal because of the Chinese factor.

*They come in with **cheaper excavators from China**, and they now have **dredges** which they **assemble during the night** and **disassemble during the day** and nobody can tell they have mined.*

³³ Vanguard [i.e. Operation Vanguard], a governmental taskforce set up to deal with Galamsey in Ghana

So, it is no longer artisanal – it is highly mechanised, using virtually almost the same tools as the LSGM sector [NL08].

As can be inferred from the above, another way in which ASSGM is operated can be characterised as ‘subletting’ (renting out). This is a situation where a concession is obtained through a formal means and rented out to any investor with an interest in ASSGM operations. Unlike the type of ASSGM operations discussed below (which seeks support from legitimate investors), the ‘Aggressive’ ASSGM form can be described as open to any prospective investor.

It is characterised by use of mechanised production methods and processing technologies that allow the sector to operate like the LSGM sub-sector, including offering employment to local people. However, because they are operated illegally, they are not environmentally accountable, and their activities impact adversely on the environment.

Arguably, this type of ASSGM activity may constitute the main challenge as well as pose the ultimate risks when it comes to illegalities involved in the sector. This is not because of the involvement of foreign nationals per se, but because of the gap created for some Ghanaians (mostly, people of power and influence) to take advantage in the absence of the lack of local support and difficulty in attracting legitimate foreign investors, to resort to illegitimate means to serve their own interests. The complexity created by the partnership between such self-interested Ghanaians and their foreign counterparts is perhaps what seems to thrive despite government actions to ban the sector’s activities.

Perhaps, it may be worth focusing attention and efforts at providing support for operators of the ASSGM sector locally and transitioning from issuing concessions to individuals, to issuing concessions to partnership, cooperative, and collaborative-based models, as recommended by the industry expert (IE01D). In this way, formalisation could be successfully achieved. The move towards such partnership models would require knowledge and understanding of how to manage complexity.

In Chapter 5, a range of relevant methods, frameworks and tools for capturing and managing complexity are demonstrated that could serve as a knowledge base to assist decision makers to understand and manage complexity.

Another way in which ASSGM operations are organised is considered next.

4.4.2.3 The viewpoint attributed to ‘rudimentary’ Galamsey operators

Regarding the more rudimentary (traditional) form of ASSGM operations, referred to as Galamsey (gather and sale), information gathered from operators of this type of ASSGM activities points to opportunities for LSGM-ASSGM collaboration. Waste materials from this traditional form of Galamsey operations contain about 70% of gold un-extracted gold ore. The nature of processing and extraction methods in use by the sector, based on artisanal technologies, can only allow for extraction of about 30% of the gold as explained below.

*Some of the **metals** will still find their way into the **gold**. We add the **mercury**, and the mercury will separate the gold from the metals. Then we **roast** it in the **fire** to burn the mercury from the gold.*

*The final phase is the **refining**, and it is **a simple process**, but we leave that part. The **buyer** will do that **before selling the gold**.*

*Aside from the gold, the **waste materials** like the **heap of sand** over there is for the buyer. **It is full of gold**, about **70%** because we only **recover about 30%**. Some **large-scale mining companies** also buy waste materials to recover the remaining 70%.*

*It is another way to make money, but it is for the buyer in return for sponsoring us. The **crusher** and **grinding** machines are all provided for free by the buyer [CL02]*

It also suggests a view that some established mining companies often express interest in the artisanal waste materials and, in the absence of a formal arrangement or support, create sponsorship opportunities to intermediaries, including gold buyers. In Ghana, people are often licensed by the Minerals Commission, to buy gold from the ASSGM sector suggesting that their activities are well-monitored and controlled.

Thus, this type of Galamsey activities seems to differ in scale and perhaps in the level of illegalities involved, compared with the type described earlier involving a partnership between local and foreign nationals. Whereas the rudimentary Galamsey activities mainly involve artisanal means of operations and processes, the other type operates using mechanised production and processing methods.

Nevertheless, the activities of the more mechanised illegal mining operations can be considered to have had some impact on the rudimentary type of Galamsey, making it to now include the use of basic processing technologies.

Also, similarly to the partnership deals involved in the more mechanised illegal mining operations, the rudimentary type of Galamsey activities is often locally operated by an individual from a mining community or with the help of groups migrating to these communities to engage in subsistence mining or with the help of an individual Ghanaian financier. Such a financier may approach a (member of) mining community for a piece of land believed to contain gold ore. This financier then sponsors the mining activities on the site, hiring labourers or site supervisors and paying wages where necessary and providing basic operational equipment. In return, such a financier or sponsor is given all the gold from the site to buy, as well as owns the waste materials from the operations which they may then sell to some large-scale gold mining companies.

The following are some of the features observed whilst on site may be considered as additional features of this type of ASSGM operations:

- ❖ **Location of site:** It was observed during the field work of this study that despite the ban on Galamsey operations, the site where this mining activities took place was located at a very open place by the main entrance of the community. Everyone knew about their activities

- ❖ **Technology/Method/tools:** Basic technology, including the use of electric powered machines for crushing and grinding of the ore (gold bearing materials). Heaps of ore materials were observed in sacks waiting to be processed
- ❖ **Processing method:** Processing is by roasting (using mercury). The environmental risk of roasting as a processing method on pollution (including acid rainfall and contamination of edible fruits such as the case of the Obuasi orange) was highlighted as part of discussions of the environment aspects of the LSGM sector. The use of such processing methods can thus expose the entire community to health risks.
- ❖ **Trading on Site:** Two main types of trading activities took place on site. One of these was subsistence food vending (women from the community engaged in the sale of food, and water etc., to the mining operators), and gold buying outlets.
- ❖ **Workforce:** An all-male workforce, some of them appear to be teenagers (ranging from early, mid and late teens) whilst others seem to be young adults.

As indicated earlier, the rudimentary type of Galamsey can often involve the support of a Ghanaian financier. In the specific case of some site Galamsey operations under discussion, the financier happened to be a licensed gold buyer. It becomes essential to thus, provide a voice to licensed gold buyers to complement our understanding of the operations of the ASSGM sector. Hence, before looking at the other way in which ASSGM operations are organised or operated in Ghana, a licensed gold buyer's voice is first considered.

4.4.2.4 A licensed gold buyer's viewpoint on ASSGM supply (value) chain

A licensed gold buyer described the business of artisanal gold buying in a way that confirms the involvement of some of them in sponsorship for the basic Galamsey operations. However, it also characterises the niche activity in a way that seems to implicate the business of artisanal gold buying with illegalities as can be deduced from the quote below.

*We are a **licensed gold dealer**. We **buy gold** from the **small-scale miners** and **export** them. Ideally, we should be selling this gold to the government through PMMC³⁴.*

*We used to do it, but now we do not because of **delayed payment**. We need to **have cash** always. We have **our men on the ground** who are **bringing in gold**, and we need the **cash to buy the gold from them**; if not **they can sell to other buyers**.*

*The **government may not pay in cash** as it goes through a **commercial bank**, and that **leads to delays** and is not **suitable for the business**.*

*There are **buyers everywhere**, some from **Dubai, China, India** and they are waiting to buy **any quantity of gold for cash**. We deal with customers who are ready to pay cash so that we can also buy more gold.*

*The most important thing is to **have a valid license**, and that is it, it is up to date [CL03]*

³⁴ PMMC is: Precious Minerals Marketing Company - Ghana

As reflected in the above quote, some licensed gold buyers, not only sponsor Galamsey operations but also, they sell some of the gold from the Galamsey activities directly to any interested buyer, including unlicensed gold buyers operating illegally in the artisanal gold market in Ghana. Such illegalities in the artisanal gold market can expose the gold mining industry to risks associated with the illicit flow of gold out of the economy through the sector's supply chain, making it a significant issue.

By subjecting the activities of the ASSGM sector to further analysis through TOC evaporating cloud (EC) and current reality tree (CRT) analyses, it may become possible to identify the underlying causes of issues facing the sector and find an appropriate solution, as explored in Chapter 5.

The presence of a local market as captured in the above viewpoint is important. However, it also seems to constitute a vulnerability and contributes to leakages through the sector's supply chain. This is particularly because of poor monitoring and control of the artisanal gold market.

This lack of effective monitoring and control of the artisanal gold market in Ghana can be considered by this study as contributing majorly to the growing illegalities and environmental challenges of the sector.

It is thus, not surprising that the ASSGM sector is considered the main concern of government, compared to LSGM sector, when it comes to managing the environmental aspect. This is because regardless of methods used to produce the gold – whether or not socially responsible or environmentally sound methods – the artisanal gold can be sold as no one seems to be monitoring the artisanal gold market in Ghana for adherence to responsible mining principles.

The above issues thus, raise the question: whether or not the artisanal gold buying should be encouraged in Ghana?

4.4.2.5 The viewpoint of an ASSGM operator: sponsorship by a foreign investor

A final perspective about how ASSGM is organised is from an individual community member who owns multiple small-scale mining concessions and wishes to transition to large-scale mining operations. It expresses frustration over the lack of financial and technical support for Ghanaians wishing to invest or transition from artisanal operations to large-scale operations.

One way in which ASSGM is operated or organised in the absence of a local support is through sponsorship by a foreign investor. If successful, this type of ASSGM operations has the potential to facilitate formalisation and impact on localised development of the gold mining industry from the viewpoint of this study. However, as this viewpoint additionally reveals, attracting a foreign investor for the needed support seems to be difficult (if not impossible) to achieve in practice by such individuals acting in isolation without any visible evidence as a proof of credibility, even though it is these operators who are permitted by law in the absence of local support.

*...as for the small scale, that is **purely reserved for only Ghanaians**, and basically the **concession is 25 acres**. But if you have a **larger concession**, let's say about **100 acres**, i.e. **4 small scale concessions** and you want to **convert to large scale** then you go to **Minerals Commission to start a new process**. As a Ghanaian, you will **face so many challenges** if you want to convert to large scale. It is **very capital intensive** as you will go through the same processes that the foreign investors will go through.*

*In my case, I had to **get my own surveyor, geologist and mining consultants and workers for prospecting and lab assay**, and **all of these involve money**. We have an institution like the **School of Mines – Tarkwa**, and the **Geological Survey Department** who can at least help when it comes to the surveying and other geological activities. But you know, they will only do it if you can pay, so it is the same thing.*

***But the law allows us to get support from a foreign investor** unlike the small-scale concession which is strictly for Ghanaians.*

*As we speak, I am looking for **foreign investors to takeover** because I don't have any money to continue with the project, **but it is where we face another challenge**.*

*It is very **difficult to get a foreign investor as an individual** because there is **a lot of scamming** going on everywhere [CL04]*

The lack of needed support for artisanal mining operators seems to constitute the primary concern to such Ghanaian ASSGM operators who own multiple concessions and are desiring to combine such concessions into a large-scale operation. This is because mining is very capital intensive and needs financial support that is often not available locally.

In the event that an investor is not found, it means all the monies sunk into surveying and prospecting activities by the prospective Ghanaian entrepreneur is locked up.

Hence, to retrieve such monies, it is likely that such an entrepreneur may end up engaging in other forms of ASSGM operations (possibly illegal?) in the hope of retrieving the locked-up capital.

4.5 Chapter summary: problem statement

The above sections representing the diversity of viewpoints from Ghana's stakeholders at various levels (community, firm, and national, and industry experts) of its gold mining industry, have highlighted several issues about the nature, structure and relationships amongst stakeholders, and other characteristics of the industry that are noteworthy.

The overall issue highlighted by the field study reflects a general concern that the industry finds it increasingly more challenging to maximise benefit for stakeholders. Multi-framing provides a range of tools and methodology that may help to address the above issue and provide a platform that may in due course support better management and decision making/problem solving about the industry.

This approach is considered next.

Chapter 5 Multi-framing analysis

5.1 Introduction

The prior chapters have demonstrated the value of taking into consideration the role of context. They resulted in insights about the complex nature, structure and relationships of the gold mining industry in Ghana and informed appropriate consideration of recommended frameworks for dealing with characteristics exhibited by the sector.

This chapter contributes to the study by building on insights from the prior chapters, seeking to operationalise the multi-framing analytical approach outlined in Chapter 2 (Figure 2.1). Details about each of the analytical tools and frameworks constituting the multi-framing approach are provided under various sub-headings in Chapter 3 including the TOC CQS framework (Figure 3.4).

In the context of TOC, studies using the CSQ framework may start with a goal tree (GT), and proceed through the current reality tree (CRT), the evaporating cloud (EC) then the future reality tree (FRT) and the prerequisite tree (PRT) (Dettmer, 2003). This study takes a slightly different approach to the CQS framework by starting with stakeholder analysis (SA), followed by supply chain analysis (SCA), then causal loop modelling (CLM) and TOC analysis to operationalise the multi-framing approach (Figure 2.1). The analysis begins with the stakeholder analysis (SA) frame.

5.2 Stakeholder Analysis (SA) frame

According to (Elias et al., 2002), a SA can be approached systematically by completing analysis at four main (4) levels, namely: rational, process, transactional and dynamic. A rational-level stakeholder analysis consists of *a stakeholder map of generic stakeholders, identification of specific stakeholders, stakes and interests of selected specific stakeholders, and development of a stake versus power grid for those specific stakeholders*. The SA approach of the authors has been updated to include an optional preparation of a project charter and analysis of stakeholder acceptance of a given project (Elias, 2016b). The development and application of the stakeholder analysis of the authors from a systems perspective is also added (Elias, 2016a).

However, the fundamental basis of the systematic stakeholder analysis articulated by Elias et al. (2002) remain unchanged and is relevant for the purpose of this study. Embracing that approach, this section seeks to build on the Elias et al's approach by demonstrating the practical utility of an industry-wide stakeholder analysis, focusing on the gold mining industry in Ghana.

In this section, attention is focused on the rational and dynamic levels of stakeholder analysis whilst addressing the *process* and *transactional* stakeholder analysis phases in Chapter 6. This allows the researcher to demonstrate aspects that are necessary for conducting stakeholder analysis. Based on this, relevant insights could be drawn to aid a more honest assessment of the

industry's understanding of its stakeholders; the nature of the process of engagement; and the extent of transactions amongst such stakeholders. This has the practical importance of helping to understand and discuss the stakeholder management capability of the gold mining industry in Ghana to inform appropriate recommendations about what may need to change.

As an example, we note that a finding that community level analysis of the mining industry in Ghana generally concludes with, is a view that the policy environment of the mining industry favours mining companies to the detriment of mining communities (Taabazuing et al., 2012). If so, then the presence of favourable legal policy that recognises and addresses undesirable consequence of mining activities, if strictly promoted and complied with by the industry, may well address for example, adverse perceptions as well as the adverse impact of mining at the community level (Hira & Busumtwi-Sam, 2018).

We also restate from the literature review (see section 2.4.2), that Ghana has developed legal frameworks and policies that govern its gold sector to minimise adverse impact/maximise value from mining investments at the micro level, including for example, the Minerals and Mining (*Compensation and Resettlement*) Regulations, 2012 (L.I. 2175). This legal instrument was designed to ensure adequate protection for the rights and interests of stakeholders of mining communities in Ghana to be specific.

We further note from Chapter 4 (section 4.2.2.1) that, there is evidence of mining companies' complying (if not exceeding regulatory requirements) of the livelihood compensation scheme (L.I. 2175) reported earlier and repeated here below.

*We [multi-national large-scale gold mining companies] do a **scientific calculation to determine the amount to pay**. For instance, if we are taking over a cocoa farm, we assume that a **cocoa tree** can yield fruits for the **farmer for the next, say 20 years** at a specific rate which is determined by the government for any affected source of **livelihood**, including the **cocoa tree**.*

We use this compensation rate as the basis to determine the amount to compensate an affected cocoa farmer. So that is what goes into compensation for a cocoa farm that is affected. We also compensate for any property that is affected.

*So, if houses are affected, we will build similar homes elsewhere, even better ones and relocate those affected. **It means if a 10-room house is affected**, we will build a 10-room house with blocks even if the affected one **were a mud house**. Some of the people, including the natives and some residents, may decide to **relocate to other destinations**.*

*In this case, they may opt for **monetary compensation** or sell the house and use the money for something else. The most important thing is that we do not just get up to start mining the gold; we compensate for everything. At least there is a discuss that goes on before as well [FL01]*

However, from section 4.2.2.2 in Chapter 4, it may be noted from a regulator's viewpoint that complexity within the livelihood chain' of mining communities has not been taken into sufficient

consideration and hence, not sufficiently managed, thereby weakening or breaking the chain despite ensuring implementation of the compensation scheme:

... as the company compensate the occupant farmer, he or she must also compensate the owner of the land. The tenant farmer is often not taken care of by the occupant.

As a result, the livelihood chain breaks that is a key challenge we are facing as regulators. It is a grey area we have not been able to tackle [NL03b]

The likelihood that the livelihood chain of mining communities may break, constitutes a challenge for regulators despite empirical evidence from primary research of the industry's compliance to requirements of the Mining and Minerals (Compensation and Resettlement) Regulations, 2012 (L.I. 2175). There is thus, a need to understand the underlying causes(s) of this issue, and as Elias et al. (2002) suggest, there is a need to adopt a stakeholder analysis approach when faced with issues affecting stakeholders.

A stakeholder analysis is thus, considered next.5.2.1 The Stakeholder map

As the literature review for this study revealed, some studies seeking to demonstrate the application of a formal SA in the context of the gold mining industry in Ghana (Famiyeh, 2017) exist. However, there is room for a more comprehensive stakeholder analysis to address the limited focus achieved by previous studies for more effective guidance.

Such a comprehensive SA can be approached by conceiving of a range of generic and specific stakeholders along the extended, sequential operations of the gold mining industry in Ghana whose daily life activities affect, and can be affected by, decisions made about the sector. This is consistent with Freeman (1984) who emphasises the need to take into consideration stakeholders in the external environment for a more effective approach to understanding and managing stakeholders.

Hence, from a rational-level analytical perspective, these stakeholders can be analysed by starting with a generic stakeholder map as shown in Figure 5.1. The generic stakeholder map tentatively groups stakeholders of the gold mining industry in Ghana under categories. These include State Powers & Government Organisations; Pan-African & Global Organisations; Special interest Groups; Investors/Customers; Junior Mid-tier & Major Mining Companies; Suppliers/Mine Support Services; Small-Scale Sector Companies; Social Cause Movements; Affected Communities; Media and Politics.

Each of these categories of generic stakeholders contains a range of specific stakeholders. Hence, by subjecting these stakeholder categories to further analysis, it is possible to identify the specific stakeholders in each category that constitute stakeholders of the gold mining industry in Ghana. This is considered next.

Figure 5.1: Generic stakeholder map of gold mining industry in Ghana

5.2.2 Specific stakeholders of the gold mining industry

Building on the high-level map of generic stakeholders demonstrated in Figure 5.1, a list of specific stakeholders can be provided that can be used to inform decision making about the management of stakeholders of the gold mining industry in Ghana.

Whilst effort to be comprehensive may be laudable, it is important to note that an exhaustive list is not intended. As demonstrated later under section 5.2.5, the concept of a stakeholder has a dynamic dimension, changing over time (Freeman, 1984). This makes the compilation of a definitive or exhaustive list of stakeholders of any industry such as the gold mining sector impossible. The input of the industry would be needed to provide a more complete list of stakeholders of any given project where necessary, particularly in the case of specific projects that may require such details.

Nevertheless, a comprehensive list of specific stakeholders constituting each of the categories of stakeholders identified above is provided in Table 5.1 below. In relation to the generic stakeholder category labelled as State Powers & Government Organisations, for example, six (6) main sub-categories have been identified: *State Powers; Ministries; Departments and Agencies; Financial Services; Higher Educational Institutions; Task Forces*.

It must be noted that, within the Ministry sub-category alone, a further range of specific Ministry stakeholders can be identified. These ministries contribute to, and impact on, the industry in

different ways. For example, whilst the *Ministry of Lands and Natural Resources (MoLNR)* has the responsibility and power to influence decision making and management about the industry, the *Ministry of Finance* has responsibilities that include overseeing the management of the fiscal regime associated with gold mining in Ghana.

Also, whilst the *Ministry of Employment and Labour Relations* has responsibility of ensuring effective use and development of knowledge, skills and human capital infrastructure for competitiveness of the industry, the *Ministry of Defence* allows for defence force to play a security role at mining sites whenever the need arises.

Additionally, the *Ministry of Local Government and Rural Development* has responsibilities that include ensuring effective use of minerals revenues for development of projects that ultimately improve the wellbeing of, particularly, mining communities in Ghana. On the other hand, the *Ministry of Business Development* has the responsibility to promote growth of the industry to create better outcomes for all Ghanaians whilst the *Ministry of Gender, Children and Social Protection* allows for development of policies and legislations to support, particularly, vulnerable stakeholders and minority groups.

Typical examples of these latter stakeholders are listed within the *Most Vulnerable Group* sub-category linked to the *Affected Communities* category of stakeholders in Table 5.1 below. These stakeholders include *Women; Children; Disabled Persons; Traditional Priests/Priestesses*. The way in which such vulnerable stakeholders experience the impact of the gold mining industry may differ from how others such as *Paramount Chiefs, Traditional Chiefs*, and others such as *Imams and the Clergy*, under the *Traditional Authority* and *Priests* sub-categories respectively, may experience the impact of the sector's activities. Similarly, *Peasant Farmers ('Abunu/Abusa')* may be disadvantaged compared to native farmers who may have ownership rights to the farmlands that allow them to engage directly or indirectly in cash crop farming activities in mining communities.

Identifying specific stakeholders within each stakeholder category can therefore be very important in contemplating the effective delivery of any given industry-related project. Even such a basic descriptive analysis and categorisation can lead to better understanding of the stakes of key stakeholders within specific stakeholder categories and sub-categories. Such knowledge and understanding can help to design solutions that are tailored to the needs of specific stakeholders depending on their stakes and interests.

Table 5.1: Specific stakeholders related to the generic stakeholder map

State Powers & Government Organisations	Pan-African & Global Organisations
<p><i>State Powers:</i> Office of the Presidency Parliament of Ghana</p> <p><i>Ministries</i> Ministry of Lands and Natural Resources (MoLNR) Ministry of Local Government and Rural Development Ministry of Employment and Labour Relations Ministry of Gender, Children and Social Protection Ministry of Railways Development Ministry of Business Development Ministry of Trade and Industry Ministry of Defense Ministry of Health Ministry of Finance Ministry of Energy</p> <p><i>Department and Agencies</i> Environmental Protection Agency Minerals Commission Forestry Commission Lands commission Water Resources Commission Environmental Protection Agency Ghana Enterprises Agency Ghana Ports and Harbours Authority Ghana Export Promotion Authority Driver and Vehicle Licensing Authority National Health Insurance Authority Ghana Revenue Authority Public Procurement Authority Controller and Accountants General's Department Community Water and Sanitation Agency Ghana Geological Survey Authority Office of the Administrator of Stool Lands Ghana Investment Promotion Centre Precious Minerals Marketing Company</p> <p>Social Security and National Investment Trust Ghana Stock Exchange Consolidated Fund Mining Development Fund Mineral Income investment Fund</p> <p><i>Higher Educational Institutions</i> George Grant University of Mines and Technology University of Energy and Natural Resources</p> <p><i>Task Forces</i> Multi-agency Mineral Revenue Task Force Inter-Ministerial Committee on Illegal Mining Operation Vanguard Economic Management Team</p>	<p><i>Pan-African Bodies</i> Pan-African Parliament African Mineral Development Centre United Nations Economic Commission for Africa Investing in African Mining Indaba African Continental Free Trade Agreement Area New Partnership for African Development</p> <p><i>Global Bodies</i> Organisation for Economic-Cooperation and Development United nations Development programme International Tropical Timber Organisation United Nations Global Compact Natural Resource Governance Institute Extractive Industry Transparency Initiative Centre for Extractive Development International finance corporation International Monetary fund World Gold Council World Bank Group Oxfam International</p> <p><i>Royalty Management</i> Agyapa Royalties Limited</p> <p><i>Refineries</i> Argor-Heraeus Metalor Technologies Rand Refinery Valcambi SA Emirate Gold Rand Refinery</p> <p><i>Markets</i> London Metal Exchange London OTC market US Futures Market Multi-Commodity Exchange of India Dubai gold and commodities exchange</p>
	Special interest Groups
	<p>Ghana Chamber of Mines London Bullion Marketing Association Women in Mining Ghana Women in Mining asanko Women in Engineering Minerals Commission Ladies Manganese Ladies Newmont Women Association and Allied Network Importers of finished gold products Licensed gold dealers/exporters - ASSGM sector Federation of Association of Ghanaian Exporters Ghana national association of small-scale miners</p>

Table 5.1 continued

Investors/Customers		Junior, Mid-tier & Major mining Companies
<i>Industry</i> Jewellery Technology <i>Investment</i> Investment Directors of companies Ninety One UK Ltd. Donald Smith & Co. Goldman Sachs CPMG Inc. JP Morgan Chase Bank LF Ruffer Gold Fund Government Employees Pension Fund Dimensional Fund Advisors Franklin Gold and Precious metals Fund Public Investment Corporation Capital Research and Management State Street Global Advisors Van Eck Vectors gold miners ETF Van Eck Vectors Junior gold miners ETF Van Eck Vectors Associates Vanguard Group Inc. Marek Vectors Junior Gold ETF Renaissance Technologies Macquarie Bank		<i>Mining Juniors (Exploration)</i> Azumah Resources Cardinal Resources Mensin Gold Bibiani Pelangio Ahafo <i>Mid-tier/Major mines</i> Nzema Mine* Newmont Ghana Gold Newmont Gold Ridge Gold Fields Ghana Abosso Gold Fields Anglogold Ashanti Iduapriem Anglogold Ashanti Obuasi* Golden Star Wassa Mine Golden Star Bogoso/Prestea Perseus Mining Chirano Gold Mines Asanko Gold Mines Adamus Resources (*) Not in production
Suppliers/Mine Support Services		Small-Scale Sector Companies
<i>Ghanaian owned</i> Riepeco Sevaco PPS West African Forgings Ghana Oil Company Zen Petroleum Rikair Limited B5 Plus Limited Electrofax Engineering Interplast Limited The Capital Group KEK Insurance Group Engineers and Planners Ramoth Services Rocksure International BCM International Thonket Plant Pool Vehrad Transport Antrak Logistics Ghana Stella Logistics Super Maritime Ghana Barbex Technical Services	<i>Local Subsidiaries</i> Fluiconnecto Ghana Cummins Ghana Intertek, Miwatek Nexans Kabelmetal Ghana Rana Motors Karl Tire Group AIA Ghana Limited Carmeuse Lime Product Total Petroleum Ghana Weir Minerals Ghana. Vivo Energy AEL Mining Services Golder Associates Ghana Metso Minerals Ghana Night Piesold Ghana Veoloia Ghana Maxam Ghana DRA Ghana Nexans Ghana SGS Ghana, PWD Ghana African Mining Services PW Mining Ghana Liebherr Mining Ghana Mantrac Ghana Pan African Mining Sandvik Mining SMT Ghana Orica Ghana DHL Global Forwarding Logistics Direct	Monex Mining Company Vimstar Gold Coast Refinery Golden Empire Legacy Samaska Company Napari Company Microgold Trust Au Resources Covenant Minerals Athena International Blaze Metals Kyei and Amankwaa Consult Premetex Ghana Asanska Jewellery Brenley Quartz Company Goldridge Ghana E.A.R. Logistics Jorly Minerals Rafimoh Gold SWB4 Company Arima Intra Ghana Guldrest Resources Company Asap Vasa Company Able Grand Resources O. M. Minerals Ghana Stelna Solution Geospence Ghana

Table 5.1 Continued

Social cause movements	Affected Communities
Ghana Anti-Corruption Coalition. Citizens Movement Against Corruption Institute for Democratic governance Integrated Social Development Centre Ghana Transparency Industry Initiative Ghana Integrity Initiative Publish What you Pay Ghana Imani Centre for Policy & Education Africa Centre for Energy Policy Ghana Public Interest and Accountability Committee Centre for Democratic development Centre for public Interest Law	Metropolitan Assemblies in Ghana Municipal Assemblies in Ghana District Assemblies in Ghana <i>Mining Communities in Ghana:</i> Traditional Authorities Paramount Chiefs Traditional Chiefs Kingmakers Queen Mothers Elders of Traditional Council
Media & Politics	Priests such as: Imams, The Clergy Unit Committee Members Assembly men Assembly women Youth Leaders Employees Unemployed persons Unemployed Graduates Petty Traders Subsistence Farmers Cash Crop Farmers Galamsey Operators
Ghana Broadcasting Corporation Ghana News Agency Multimedia group Despite Media Angel Broadcasting Network Tiger Eye PI <i>Main political parties</i> New Patriotic Party National Democratic Congress <i>Woman-led political parties</i> National Democratic Party Ghana Freedom Party	<i>Most Vulnerable Groups such as:</i> Women Children Disabled Persons Peasant Farmers Traditional Priests/Priestess

5.2.3 Stakes of selected stakeholders of the gold mining industry

Following the descriptive analysis and identification of specific stakeholders as demonstrated above, it is considered important to analyse the stakes and interests of selected stakeholders (Elias et al., 2002). This phase of analysis is particularly important because different stakeholders experiencing the impact of gold mining in different ways will have different needs and priorities, wishes and desires, wants and expectations from the industry.

Analysing the stakes of selected stakeholders can facilitate identification and effective management of the impact that gold mining has on the different categories of stakeholders. Without understanding the stakes and interest of stakeholders, beneficial company-initiated interventions, such as the Bogoso Oil Palm Plantation (BOPP) project (Medinilla, 2016) or the livelihood compensations scheme aimed at addressing poverty and other adverse impacts, risk becoming imprecisely targeted. As such, they may fail to effectively address the livelihood challenges and the adverse impact of the sector's activities in mining communities as Hilson and Banchirigah (2009) imply. Such issues may results in operational conflict between mining communities and mining companies (Taabazuing et al., 2012).

This is because interventions such as the BOPP, if not appropriately targeted, have the potential to disproportionately benefit some privileged stakeholders in mining communities such as chiefs and kingmakers who have indigenous rights to farmlands. However, others such as the ‘*Abunu/Abusa*’ may not benefit in like manner because they may not have the same privileges, as indigenous land ownership can act as a catalyst to benefit from the full potential of projects such as the BOPP.

To illustrate, identifying and interpreting the stakes of selected specific stakeholders of the gold mining industry in Ghana can be facilitated using Table 5.2 below. It is important to note that the selection of stakeholders for analysis at this level depends on the specific project at hand. The table’s column structure guides the identification and analysis of the stakes and interests of specific stakeholders whilst relating those details to the role and identity played by such stakeholders.

For example, for the highest-level generic stakeholder category *State Powers & Government Organisations*, *The President*, as a specific stakeholder, has stakes that relate to the role of *Head of state or government of Ghana*; and stakes that relate to the overall well-being of Ghanaians; good governance and accountability. Within the same high-level generic stakeholder category, others such as *Parliamentarians* have stakes that include law making, holding the government to its policies and actions, and management of fiscal revenues of Ghana, including those derived from the rich mineral resource endowment of the country on behalf of the people.

It must be noted that even though specific stakeholders may share characteristics that associate them with the same high-level generic stakeholder category, there will necessarily be other characteristics that define differences in stakes and interests, attributes, and stakeholder relationships. Similarly, whilst characteristics may be expected to differ between stakeholders in different high-level generic stakeholder categories, for example, the *State Powers and Government Organisation Category* and *Pan-African & Global Organisations* categories, the reason for any such differences must be surfaced, and relationships explored by extending the analysis beyond mapping.

As Elias et al. (2002) imply, stakeholders are characterised by two main attributes, namely: *Stake* and *Power dimensions*. Hence, by analysing the *stakes versus power* dimensions of selected stakeholders, it is possible to understand the relationships and differences between and amongst related and seemingly unrelated stakeholders.

Hence, analysis of the *stakes versus power* of selected stakeholders is thus, considered next.

Table 5.2: Stakes Interests, role and identities of selected specific stakeholders

Generic Stakeholder	Specific Stakeholder	Stakes/Interests	Impacts on the stakeholder relating to role and identity
State Powers & Gov't Organisations	Office of the President (The President)	Head of government of Ghana; Overall well-being of all Ghanaians Good governance; Accountability to the people	Political image; Tenure of office; Endorsement of political party; International reputation; Trust and Confidence
	Parliament of Ghana (Parliamentarians)	Law making; Accountability to the people of Ghana Accountability to the people	Patriotism; Integrity; Trust, public confidence and recognition
	Ministry of lands and natural resources (MoLNR) (The Minister)	Better management and sound decision making about mineral resources of Ghana; Ghana's benefit from gold mining sector	Loyalty to the State; Professional exposure, fulfilment and reward; Integrity; Trust and Confidence
	Ministry of Gender, Children and Social Protection (The Minister)	Gender equality; Recognition and protection for the right of women and children affected by mining activities Productive capacity of women in mining	Loyalty to the State; Professional exposure, fulfilment and reward; Integrity; Trust and Confidence
	Precious Minerals Marketing Company	Responsibility for industrywide assay of gold produced in Ghana, and sub-regions in Africa; Management of licensed gold buying in Ghana; Exportation of gold on behalf of ASSGM sector; Industry leader in jewellery making in Ghana	Institutional capacity, capability and Integrity; Loyalty to the State; Staff rewards, exposure and career fulfilment; Sales, customer loyalty and reputation
	Ghana Revenue Authority	Implementation and administration of the fiscal regime (royalty tax system) associated with mining activities in Ghana	Institutional capacity, capability; Integrity; Loyalty to the State; Staff rewards, exposure and career fulfilment
	Minerals Commission	Implementation and administration of the legal framework of mining of the resource endowment of Ghana	Institutional capacity, capability; Integrity; Loyalty to the State; Staff rewards, exposure and career fulfilment
	Environmental protection Agency	Environmental Analysis and management; Maximisation of overall (minimisation of adverse) impact of Mining Activities in Ghana	Institutional capacity, capability; Integrity; Loyalty to the State; Staff rewards, exposure and career fulfilment
	Geological Survey Authority	Research and Development of mining industry; Provision of geological and geophysical information about mining industry in Ghana	Institutional capacity, capability; Integrity; Loyalty to the State; Staff rewards, exposure and career fulfilment

Table 5.2 Continued

	Mineral Income investment Fund	Monetisation of royalties associated with gold mining Management of income from gold mining	Institutional capacity, capability. Integrity; Loyalty to the State Staff rewards, exposure and career fulfilment
	George Grant University of Mines and Technology	Specialised higher education in mining; Research and consulting; Training and development of mining professionals; Provision of human resource infrastructure	Accreditation; Research quality; Global ranking and
Pan-African and Global and local Market intermediaries	African Mining Vision	Inclusive Minerals Led development among African State Operationalisation of the PAN-African mining vision	Capacity of local industries. Harnessing of backwards linkages; Greater economic benefits to Ghana
	United Nations Global Compact	Socially responsible and environmentally friendly production and consumption. Global sustainability	Successful achievement of the 2030 SDG agenda
Customers/ Investors	Van Eck Vectors Associates	Provision of needed funds majority of mining companies operating in the LSGM sector; Maximum return on Return on Investment.	Corporate image; Market performance; Share Value; Stock price; Business growth
	Macquarie Bank	Hedging agreement with some mining companies in the LSGM sector in Ghana	Corporate image; Market performance; Share Value; Business growth
Junior, Mid-tier and major mining companies	Gold Fields Ghana	Largest company in gold mining industry in Ghana Shareholder value creation	Corporate image; Market performance; Share Value; Stock price; Business growth
	Newmont Gold	Shareholder value creation	Corporate image; Market performance; Share Value; Stock price; Business growth
Suppliers/Mine Support Services	BCM International	Biggest local competitor in contract and owner mining activities	Corporate image; Market performance; Share Value; Stock price; Business growth
	AEL Mining Services	Safe and manufacture and delivery of explosives	Corporate image; Market performance; Share Value; Stock price; Business growth
	Mantrac Ghana	Provision of original equipment solutions power systems and parts	Corporate image; Market performance; Share Value; Stock price; Business growth
Media & Politics	Multimedia group	Credible commercial reportage, documentary and dissemination of information for public consumption	Ratings; Readership, Viewership; Sales commercials; Revenue; Media Rights.

5.2.4 Stakeholder grid of selected stakeholders

For a more complete SA at the rational level, understanding the *stakes versus power* combination of selected stakeholders is also important. As demonstrated in Table 5.3 below, the Power dimension allows for analysing stakeholders according to the nature of power or influence that they can exercise, wittingly or unwittingly. Such Power can be categorised as *Formal/Legal, Economic or Social/Political* in nature. In relation to the Stake dimension, stakeholders are analysed based on three categories of stakes, namely: *Equity, Economic or Influence Stake*. As indicated, the combination of the stake and power exhibited by stakeholders can be a defining characteristic of the stakeholder. This means it is then possible to identify similarities, differences and relationships between seemingly unrelated stakeholders and identify and understand differences between otherwise related stakeholders.

For example, when examining the Economic dimensions of Power and Stakes variables, the shared nature of properties held by specific stakeholders such as *Employees* and *Goldfields Ghana* from seemingly unrelated generic stakeholder categories, respectively *Affected Communities* and *Junior, Mid-tier & Major Mining Companies*, can become more obvious or evident in hindsight. Here, analysis shows that these stakeholders are related by virtue of the similarity of the patterned relationship of their Formal/Legal power and Economic Stake characteristics.

By contrast, the differences between stakeholders such as *BCM International* and *African Mining Services* belonging to the same *Supplier/Mine Support Services* generic stakeholder category, may not be so obvious. However, the *stakes versus power* grid analysis for these stakeholders, can make their differences become evident. For example, whilst *BCM International* possesses an *Economic Stake* similar to *African Mining Services*, the two of them differ based on how they possess and exercise *Power*. Whereas the latter can be considered as wielding *Economic Power*, the former (*BCM International*) as a Ghanaian Owned business, is conferred with legislated privileges as a domestic business that conveys relative *Legal/Formal Power*.

The differences in the *Power* possessed by these two stakeholders can afford *BCM International* a competitive advantage over *African Mining Services* when such companies compete for a contract in the industry. Such power dynamics may favour *BCM International*, discourage fair competition and over time, limit the ability of their competitor, *African Mining Services*, to win contracts, and hence, adversely impact on international competitiveness of the industry if not rectified. As another example, we note the perhaps unpredicted similarity of characteristics among specific stakeholders such as *Women in Mining Ghana (WiMiG)*, *Imani Centre for Policy & Education (ICfP&E)* and the *Parliament of Ghana*, each belonging to different generic stakeholder categories, namely the: *Special Interest Group, Social Cause Movement* and *State Powers and Government Organisations* categories respectively. However, by undertaking the *stakes versus power* grid analysis of these stakeholders, it becomes obvious that they wield similar *Power* which is of a *Formal/Legal* nature and share similar Stakes and Interests as *Influencers*.

The impact of other specific stakeholders such as *Macquarie Bank*, *Goldman Sachs*, and *Van Eck Vector Associates* amongst overseas actors may not be evident at the generic level. Similarly, others such as the *Pan-African Parliament* and the *United Nations Global Compact* may be taken for granted. However, by means of *power versus stakes analysis*, it becomes obvious that these stakeholders share similar attributes with the *Parliament of Ghana* and the *MoLNR* as influencers within the industry. Their activities and influence need to be taken into consideration when making industry-related decisions as they affect and can be affected by, the industry directly or indirectly.

A rational-level of *power versus stakes* is illustrated in Table 5.3 below, and is followed by an exploration of stakeholder dynamics.

Table 5.3: Stakeholder grid for selected stakeholders

Stake	Power		
	Formal/Legal	Economic	Social/Political
Equity	Ghana Revenue Authority	Ghana Revenue Authority	
Economic	Employees Goldfields Ghana Golden Star Resources Newmont Ghana Pelangio Ahafo Mining Development Fund BCM International	Mantrac Ghana Sandvik Mining Ghana AEL Mining Services African Mining Services	
Influencers	Parliament of Ghana Ministry of Lands and Natural Resources Ministry of Finance Ministry of Gender, Children and Social Protection Agyapa Royalty Limited Ghana Chamber of Mines Women in Mining Ghana Imani Centre for Policy & Education Mine Workers Union	Macquarie Bank Goldman Sachs Van Eck Vector Associates	Pan-African Parliament New Patriotic Party National Democratic Congress United Nations Global Compact International finance corporation

5.2.5 The concept of stakeholder dynamics

Here, the researcher seeks to shed light on important notions and characteristics of stakeholders that are useful in conceptualising and conducting dynamic-level stakeholder analysis. Following Mitchell et al. (1997) the following table can be used to describe relationship attributes that facilitate the identification and categorisation of stakeholders. These attributes are important for a dynamic level stakeholder analysis. Hence, they are illustrated first before providing typical examples of a dynamic stakeholder analysis.

Table 5.4: Stakeholder power, legitimacy and urgency

Stakeholder Attributes – Some Operational Definitions	
•	<i>Power</i> – According to Mitchell et al. (1997), a party to a relationship has power, to the extent it has or can gain access to coercive, utilitarian or normative means, to impose its will in the relationship
•	<i>Legitimacy</i> - Suchman (1995) defined legitimacy as a generalised perception or assumption that the actions of an entity are desirable, proper or appropriate within some socially constructed system of norms, values, beliefs and definitions
•	<i>Urgency</i> - (Mitchell et al., 1997) defined urgency as the degree to which stakeholders' claims call for immediate attention, thereby introducing the dimension of time. Thus, by including urgency as an attribute, a dynamic component is added whereby stakeholders may attain different levels of salience, which, in the minds of managers or decision makers, change over time.

5.2.5.1 A typology of stakeholders

Firstly, it must be noted that if a stakeholder(s) possesses only one of the three attributes, they are termed *latent* stakeholders and have low stakeholder salience. Among latent stakeholders, those with one attribute such as:

- Power are called *dormant* stakeholders
- Legitimacy are called *discretionary* stakeholders
- Urgency are called *demanding* stakeholders.

Table 5.5: Clarifying the concept of latent stakeholders

Identifier	Power	Legitimacy	Urgency	Characteristic
1	x			Dormant
2		x		Discretionary
3			x	Demanding

Secondly, stakeholders possessing two of the three attributes are termed *expectant* stakeholders and have moderate stakeholder salience. *Expectant* stakeholders are described as follows:

- Power and legitimacy are called *dominant* stakeholders
- Power and urgency are called *dangerous* stakeholders
- Legitimacy and urgency are called *dependent* stakeholders

Table 5.6: Clarifying the concept of expectant stakeholders

Identifier	Power	Legitimacy	Urgency	Characteristic
4	x	x		Dominant
5	x		x	Dangerous
6		x	x	Dependent

Thirdly, it is additionally noteworthy that if a stakeholder possesses or is perceived to possess all three attributes, (i.e. power, legitimacy and urgency), they are termed: *definitive* stakeholders and have high stakeholder salience as shown in Figure 5.2 below.

- Power, legitimacy and urgency are called *definitive* stakeholders.

Table 5.7: Clarifying the concept of definitive Stakeholders

Identifier	Power	Legitimacy	Urgency	Characteristic
7	x	x	x	Definitive

Finally, Mitchell *et al*'s typology of stakeholders is provided below in the form of a Venn diagram (Figure 5.2). From this diagram, we denote the dynamic nature of stakeholders using the red dotted lines. For example, the direction of flow of the red dotted line from region 1 (Dormant Stakeholders) to region 5 (Dangerous Stakeholders) indicates a stakeholder whose power dynamics may have changed from being latent (possession of *power only*) to become a dangerous stakeholder (possession of *power and urgency*).

Similarly, the direction of the red dotted line from region 8 (Non-Stakeholder) to region 7 (Definitive Stakeholder) shows how a stakeholder moved from being a *non-stakeholder* to acquire all three (3) attributes, namely *legitimacy, power, and urgency* over time.

Figure 5.2: Stakeholder typology – Venn Diagram Representation Source: Mitchell et al. (1997)

5.2.5.2 An indicative dynamic level stakeholder analysis

In view of the above characterisation, this section now shows how stakeholder characteristics and attributes can change over time, by illustrating how for example, a special interest group, like the *Women in Mining (WiM) Ghana* can move from being a non-existent or *Latent stakeholder* with *Legitimacy* prior to Ghana's subscription to the United Nations sustainable development goals (SDGs) agenda unfolded, to being a *Dominant*, then a *Definitive stakeholder*.

Figure 5.3 and Table 5.8 provide the results of such an indicative analysis of the dynamic nature of stakeholder characteristics, showing, for example, that the *Women in Mining Ghana (WiMiG)*,

the *Imani Centre for Policy and Education (ICfP&E)* may be described initially as *Dominant* stakeholders exhibiting characteristics of *Power* and *Legitimacy*. However, following the acceptance of the UN SDGs, both WiMiG and ICfP&E display the characteristic of *Urgency*, to become *definitive* stakeholders, as they take responsibility and act to respond to SDGs and requirements, and promote their activities and advocacy.

Applying a similar notion, the *Agyapa Royalties Limited (ARL)* can also be described as *non-stakeholder* prior to 2018. Following the approval of the *Mineral Income Investment Fund (MIIF) Act 2018 (Act 978)*, *ARL* can now be considered to move from a non-stakeholder to become a *definitive stakeholder*. The analysis also considers the issue of the ban of Galamsey and the impact on the Power, Legitimacy and Urgency on Galamsey within the Affected Communities category of stakeholders.

Table 5.8: Stakeholder dynamics – attributes of selected specific stakeholders

Chart of Stakeholder Attributes – demonstrating Stakeholder Dynamics of how attributes change over time in relation to emergence of significant events -for specific stakeholders that can be labelled as dangerous, dominant or definitive stakeholders					
Defining Events: 2016 Adoption of UN SDG					
Generic Category	Sub-Category	Specific Stakeholder	2010	Prior to 2016 Adoption of UN SDGs	Post 2016 Adoption of UN SDGs
Special Interest Groups	Special Interest Groups	Women in Mining Ghana	--	PL	PLU
Social Cause Movement	Social Cause Movements	Imani Center for Policy & Education	pL	PL	PLU
Defining Event: 2018 Adoption of MIIF Act 978					
Generic Category	Generic Stakeholder	Specific Stakeholder	2010	Prior to 2018 Adoption of MIIF Act 978	Post 2018 Adoption of MIIF Act 978
Pan-African & Global Organisations	Royalty management	Agyapa Royalties Limited	--	--	PLU
Defining Event: 2017 Ban on Galamsey					
Generic Category	Generic Stakeholder	Specific Stakeholder	2010	Due to 2017 Ban on Galamsey	Post 2017 Ban on Galamsey
Affected Communities	Mining Communities	Galamsey Operators	LU	--	--
Legend: P: Enhanced Power; L: Enhanced legitimacy; U: Enhanced legitimacy p: Limited power l: Limited legitimacy; u: Limited legitimacy; --: No attribute					

Table 5.8 can be subjected to alternative presentation using the stakeholder typology (Mitchell et al. (1997).

This would allow for assessment leading to understanding of the stakeholder management capability of the gold mining industry relative to the management of specific projects. This may include issues such as the *ban on Galamsey* as illustrated in Table 5.8 and others such as the *community livelihood compensation (CLC)*, and the *monetisation of the royalties*. The analysis, using the stakeholder typology, is shown in Figure 5.3 below

The below stakeholder typology shows the dynamics that characterise the *Women in Mining Ghana, Imani Center for Policy & Education, Agyapa Royalties Limited, and Galamsey Operators* as specific stakeholders of the gold mining industry in Ghana over time. Relevant aspects are discussed further under section 6.6 in Chapter 6, along with aspects relating to the process and transactional-level stakeholder analysis.

Figure 5.3: Stakeholder dynamics of specific selected stakeholders over time – Venn diagram

5.2.6 Summary of key points from the stakeholder analysis

A number of issues have been raised and discussed whilst demonstrating the concept of rational and dynamic-level stakeholder analysis in this section. The key points are: firstly, different stakeholders experience the impact of the gold mining industry in Ghana in different ways. Hence, analysis and management of the impact of the industry needs to focus on relevant specific stakeholders for a more effective outcomes.

Secondly, stakeholder analysis has the potential to aid understanding of the relationships and differences amongst seemingly unrelated/related stakeholders. Such knowledge can be used to inform the management of relationships amongst stakeholders of the gold mining industry in Ghana to enhance international competitiveness of the industry.

Thirdly, through stakeholder analysis, the dynamic nature of the attributes of specific stakeholder within the gold mining industry could and should be analysed in the context of projects development and implementation. This is because the Power, Legitimacy and Urgency of stakeholders can change over time. As such, a non-stakeholder of a project could, in future, become a definitive stakeholder of the project, with a corresponding increase in power and legitimacy to influence project decisions. By contrast, some formerly influential stakeholders may lose their legitimacy and power over time. Hence, regularly updating the list of specific stakeholders as suggested by Freeman (1984) is critical. The stakeholder typology of Mitchell et al. (1997) can be very instrumental for this exercise.

Finally, as reflected in Table 5.1, the stakeholder analysis in this study covered an extensive array of stakeholders across the horizontal, sequential chain of mining activities from one end of the industry's supply chain to the other end. Understanding how value is created and distributed amongst key stakeholders across the chain could lead to insights for change and improvement. Such understanding, knowledge and insights could be enhanced by means of a supply chain analysis which allows for mapping the system-wide flow and distribution of value-adding activities amongst stakeholders.

A supply chain analysis frame is considered next.

5.3 Supply chain analysis frame

“Supply chain management is the management of relationships in the network of organizations, from end customers through original suppliers, using key cross-functional business processes to create value for customers and other stakeholders” (Lambert, 2014, p. 2).

On a matter of relevance to this study, Porter (1990) implied that nations would benefit from developing the capacity of domestic supply chains for competitive advantage instead of relying on foreign capacity. In this regard, one of the important questions that needs to be addressed in this section relates to how we can improve understanding about opportunities for the establishment of competitive advent and economic development in Ghana by building awareness of and embracing a supply chain approach (Bloch & Owusu, 2012).

This section thus, operationalises a conceptual framework for supply chain analysis that can be used to provide better understanding about the notion of supply chains to inform the development the of domestic supply chains. The framework reflects the researcher’s understanding of the gold mining supply chain as comprising three main sub-sub-systems, namely: the upstream, internal and downstream.

Figure 5.4: Conceptual framework for supply chain analysis

As operationalised below, the above high-level framework also satisfies key aspects of the notion of supply chain management (CSCMP, 2013; Lambert, 2014; Schragenheim et al., 2009), including the concept of forward and backwards flow of information, products, money (Lambert & Enz, 2017) to ultimately create and distribute value across the chain.

5.3.1 Operationalising the framework

The Figure 5.4 framework suggests that a range of analyses are possible, depending on whether a functional or a systems-based managerial approach is taken. From a functional perspective, this can be considered in terms of conceptual and/or operational boundaries between and across the upstream, internal, intermediary and consumption links in the framework. At a more basic level, it can also be considered in terms of individual companies within each link of the above framework operating or competing on their individual strengths.

For example, it can be looked at in terms of suppliers in the upstream link competing for share of value added with respect to mining companies; in terms of mining companies seeking to lower the cost of operations to maximise shareholders' value; and of intermediary companies thinking more in terms of increasing their share of profits relative to mining companies.

However, the consumer as 'initiators' of the chain of activities in Figure 5.4 (i.e., consumers in the downstream) are more likely to suffer the adverse consequence of a more fragmented or discrete approach by supply chain participants seeking to maximise their own returns with a likely consequence of raising costs/prices for consumers. In addition, the nature of the gold mining industry is such that demand often exceeds supply of gold, compounding the cost impact on consumers. However, other impacts, for example, inputs costs can be more directly experienced by mining companies.

The high-level framework also lends itself to developing a systems-based approach evolving systems perspectives on the related conceptualisations of supply chain (SC) and value chain (VC). In the context of this study, both sets of perspectives will be considered. However, attention is focused on providing an understanding of such conceptualisations in a manner that can ultimately serve the interest of government and the industry to identify opportunities for improvement that can maximise sector benefits/value creation for stakeholders.

Such understanding can be provided by embracing the notion of an extended or comprehensive supply chain, encompassing the totality of everything involved in forward and backwards flow activities in the gold mining system from identifying the presence of gold ore to retail sales of various gold-related products, (i.e. From one end of the chain to the other end).

As such supply chain analysis can facilitate and encompass related analysis of how value is added in upstream stages to the initial raw materials, assess the relative contributions of companies involved in the chain to the final consumer downstream, and then map specific items or services consumed by the industry back to the original sources of supply. Such an approach is illustrated below starting with the gold ore value chain.

5.3.2 Supply chain analysis focusing on forward linkages

As illustrated below, one of the main issues highlighted by field study participants relates to the impact of the export-driven nature of the mining model used in Ghana and how the export-driven approach, whilst contributing to government revenues, primarily through royalties, is also responsible for a significant amount of value-adding activities being undertaken by, and hence, benefiting overseas businesses (section 4.4.1.1).

*How we have developed our gold mining sector is not different from how the forerunners of the industry, our **colonial authorities**, ran the industry. The **purpose** was just to **produce the ore here, ship it abroad**, and then they will **add the value to it externally**.*

The Queen was in control of Ghana, all the assets in the country belonged to her. So, what they did then was they mined the gold ore in Ghana, exported raw gold out of the country, added value to it and paid a royalty to the Queen because she was the owner of the resources at the time.

Of course, the government at the time also used part of the revenue realised to develop the country, in those days, the Gold Coast. We can point to Kele-bu Teaching Hospital and the Achimota Hospital as typical examples.

The point here is that the model that we inherited from the colonial period is what we are following. We have not decided to change the model. For instance, we mine in the country and export everything and import most of the inputs.

What will remain in our country are few services that some of our local businesses can provide, the taxes that the government can collect, and the salaries paid to employees.

The chunk of the money will dissipate or leave the country through the importation of inputs, and exportation of output and significant profits are also repatriated [NL06]

This study notes the congruence or otherwise between the practical reality as captured above and the theoretical understanding from the literature on Ghana's export potential of gold. For example, the call for a change from the current approach of value creation (based on the export driven model positively aligns with insight from the literature regarding the President of Ghana's intention for a new paradigm of value creation – based on a supply chain approach (see section 2.2.3.2).

Mapping the gold ore value chain can help to understand how value is created and distributed amongst key stakeholders of the gold industry in Ghana to inform what may need to change. It may be assumed that no value is added to the gold ore until the start of research and development relating to discovery and exploration activities.

Figure 5.5 illustrates the sequential processes and value-adding activities involved in the specific context of the gold mining industry in Ghana from ore reserves to final consumers. Note that this is accompanied by Table 5.9 which provides quantitative data on relevant aspects that can help to evaluate particularly, the financial aspects of the mining business in Ghana.

Figure 5.5: Provisional map of the gold value chain to final consumers, illustrating the sequencing of processes in the chain.

Table 5.9: Quantitative data on exports (ounces) & revenues and expenditure (USD)

Producer/ Exporter	Export (Ounces)					Revenues				
	Period: 2015-2019					Period: 2015-2019				
	2015	2016	2017	2018	2019	2015	2016	2017	2018	2019
company A	586,051	568,036	566,388	524,869	519,072	680,689,902	708,864,563	710,828,770	666,903,612	720,369,121
Company B	472,632	470,313	473,390	414,427	422,099	548,633,233	586,878,575	593,501,515	525,562,745	594,777,021
Company C	331,507	348,861	349,032	436,106	643,067	386,930,281	434,741,967	437,410,929	552,814,514	889,522,223
Company D	192,522	214,196	227,833	253,487	274,665	223,433,033	268,261,229	285,592,063	322,611,642	390,021,741
Company E	255,377	211,440	245,511	226,370	201,037	301,539,585	258,313,956	317,626,290	285,981,659	281,559,113
Company F	189,527	153,208	208,226	217,219	179,574	259,536,265	165,324,528	252,542,488	276,642,909	245,169,396
Company G	-	162,802	205,047	223,152	251,044	-	195,388,905	256,203,177	285,008,422	343,187,228
Company H	167,831	147,720	143,568	180,844	208,381	194,810,509	183,390,746	180,268,662	228,953,694	288,346,709
Company I	108,266	104,380	137,234	149,698	156,168	124,569,806	129,284,717	172,864,696	190,015,785	217,382,101
Company J	114,150	89,673	130,331	75,087	47,533	133,303,230	111,970,441	164,261,555	95,837,297	66,820,357
Company K	110,401	87,710	117,242	103,731	84,197	128,341,506	107,150,748	147,685,310	131,032,157	119,272,938
Company L	52,648	3,072	2,796	-	-	65,698,815	3,268,846	3,460,288	-	-
Sub-Total	2,580,912	2,561,411	2,806,598	2,804,990	2,986,837	3,047,486,165	3,152,839,221	3,522,245,743	3,561,364,436	4,156,427,948
Ghana	267,662	1,570,029	1,478,687	1,985,600	1,587,888	273,149,043	1,999,943,636	-	-	-
Other	-	-	-	-	-	70,581,339	104,807,091	-	297,006,753.99	415,194,770.23
Total	2,848,574	4,131,440	4,283,467	4,790,590	4,574,725	3,397,855,587	5,262,521,105			
Other Spends						Spend on Power, Diesel and other Consumables				
	Particulars						In-country purchases			Imported
Year	CAPEX	Amortisa- tion	Labour	Share- holders	CSI	State	Power	Diesel	Other consumables	consumables
2015	418,162,161	-	429,970,000	-	17,830,000	-	-	-	865,000,000	166,000000
2016	452,900,000	329,700,000	435,600,000	33,000,000	12,200,000	327,200,000	375,900,000	301,100,000	1,010,000,000	216,800,000
2017	695,800,000	349,400,000	515,100,000	36,800,000	19,800,000	400,400,000	307,200,000	285,600,000	1,230,000,000	215,600,000
2018	720,564,000	202,060,000	450,071,000	261,153,000	24,093,000	632,341,000	246,999,000	320,599,000	1,702,000,000	204,824,000
2019	203,700,000	165,500,000	463,350,000	103,510,000	24,450,000	701,810,000	316,350,000	342,050,000	1,880,000,000	544,220,000

Compiled from Data Available from the Database of Ghana Chamber of Mines <https://www.ghanachamberofmines.org/>

5.3.3 Supply chain analysis focusing on backwards linkages

“A true supply chain encompasses every step of activity from the provision of raw materials to the end user” (Schrage et al., 2009, p. xiii)

Separate from the matters referred to above, which are specific to value chain (flow of value downstream), there are other matters raised in the field study (data collection) that can be illustrated by mapping the specific items consumed by the gold mining industry back to the original sources of supply. As illustrated below, one of the main issues relates to a reliance on overseas suppliers for the supply of most mining inputs because of the absence of a Ghana-government-led policies for strengthening organisational capacity within local supply chains (see section 4.4.1.3).

In terms of statistics, about 90% of materials are bought from overseas and about 10% from local sources.

We are not benefiting much from the sector, and the reason is that our local suppliers rely on overseas suppliers.

So the 10% we source from local suppliers end up coming from overseas because we have not developed the capacity of our local supply chains to independently supply most inputs required by the gold industry locally [FL06]

Another key issue from the field study, illustrated below, raises questions about the collapse of specific companies linked to the mining industry in Ghana (see section 4.4.1.4) These are, for example, the *Firestone Tyre Company* as an input supplier to the industry, and the *Tarkwa Gold Refinery* for downstream processing of value-adding gold refining activities locally in Ghana.

Go to Tarkwa and you will be surprised to find that the gold refinery that was built by Dr Kwame Nkrumah is abandoned and left to rot. It has now become a student hostel. All the machines are left to rot.

There used to be a company that produced Firestone Tyres. Now Firestone is no longer produced in Ghana. As long as people are increasingly importing vehicles into the country, tyres will be needed.

Yet a company like that is left to rot? We are talking about a factory which had got about 80% of the raw material in the country. When Dr Kwame Nkrumah established the tyre factory, he additionally established rubber plantations as a source of raw material.

We have sold most of these rubber farms to GREL following the collapse of the [Firestone] Tyre Company. At least if not machine tyres, light vehicle tyres were being produced in Ghana, and that is where we were all bought our vehicle tyres from.

But now all tyres are imported from overseas. So, we have to revive abandoned companies that have a link to the industry, especially those that do not depend on gold for raw materials such as the Firestone Tyres.

Probably the technology has changed, and so we may have to catch up, but it will not be like starting afresh [IE01c]

Such issues surfaced from the field study clearly validate a key question raised in the literature about how to improve understanding about opportunities in backwards linkages that may need to be strengthened to boost the sector's contribution to economic development in Ghana (Bloch & Owusu, 2012).

Other issues from the field study relates to a growing illegalities of Galamsey:

*We are a **licensed gold dealer**. We **buy gold** from the **small-scale miners** and **export** them. Ideally, we should be selling this gold to the government through PMMC³⁵.*

*We used to do it, but now we do not because of **delayed payment**. We need to **have cash** always. We have **our men on the ground** who are **bringing in gold**, and we need the **cash to buy the gold from them**, if not **they can sell to other buyers**.*

*The **government may not pay in cash** as it goes through a **commercial bank**, and that **leads to delays** and is not **suitable for the business**.*

*There are **buyers everywhere**, some from **Dubai, China, India**, and they are waiting to buy **any quantity** of gold for cash. We **deal with customers who are ready to pay cash so that we can also buy more gold**. The most important thing is to **have a valid license**, and that is it, it is up to date [CL03].*

The above issues – the collapse of some key sectors linked to the gold mining industry in Ghana including the *Firestone Tyre Company* and the *Gold Refinery in Tarkwa* (section 4.4.1.3) and growing Galamsey-related illegalities have broad implications for supply chain security and integrity. Addressing such concerns relating to key contributors to the mining sector supply chain can be appropriately approached by mapping the specific separate supply chain subsystems for tyres and gold to then inform a wider supply chain analysis.

Such mapping is illustrative of how the wider supply chain may be mapped. Using the framework of Lambert and Enz (2017) outlined in Chapter 3 (Figure 3.2), the illustrative supply chain is mapped for tyres (Figure 5.6) as one of the critical items consumed by the gold mining industry. An equivalent high-level supply chain for gold production from ore reserves to end user product is shown in Figure 5.7.

³⁵ PMMC is: Precious Minerals Marketing Company - Ghana

Figure 5.6: The tyre supply chain from origin to consumption

Figure 5.7: The gold supply chain from ore reserves to consumption, illustrating organisational and sector involvement.

Relevant aspects of Figure 5.7 are discussed under appropriate sections in Chapter 6.

5.3.4 Key points from supply chain analysis (SCA)

This section has outlined a conceptual framework for SCA and distinguished between related conceptions of the value and supply chain. Whilst the latter facilitates the functional management of the totality of flows from consumption through suppliers (backwards flow) in the upstream and back to the consumption (forward flow), the former can be considered as a unidimensional flow from upstream to downstream. Key findings of this section and their implications will be discussed under section 6.7 in Chapter 6.

However, it is worth noting here that whilst participant viewpoints from the field study conducted for this research reflected concerns about both the export-driven orientation and the under-realised export potential for gold (perhaps because of how the ASSGM functions and related leakages), the data in Table 5.9 portrays growth in exports. Nevertheless, Figure 5.7, reflects an awareness at the conceptual level that the ASSGM sector can and does complement the LSGM sector in creating benefit for Ghana by contributing to realisation of export potential.

However, findings from the field study, as well as the literature, indicate that adequate support for the development of the full potential of the ASSGM sector is not currently being provided by either government or the LSGM sector. This is another key concern as it exposes the industry to supply chain integrity and security risks.

So far, the stakeholder and supply chain/value chain frames have characterised the systems-related perspectives of the multi-framing approach. The stakeholder analysis (SA) has surfaced complexity and scale in terms of the number of stakeholders, and how their interactions are influenced by the dynamic nature of their attributes and change in the environment. Supply chain/value chain notions have facilitated the holistic framing of interactions between stakeholder participants in a chain according to their logical, time-related sequential and functional role in the wider chain system.

The next section contributes to an understanding of Ghana's export potential for gold by continuing the development of systems perspectives through the use of causal loop modelling (CLM) and its associated causal loop (CLD) diagrams. Complementing other approaches, CLM explores the nature of cause-effect relationships and dynamics seeking to better understand how situational context impacts the export potential of gold.

5.4 Causal loop modelling frame

This section will contribute to the purpose of this study in two major ways. First, it will create visual representations of behaviour over time (BoT) for key variables within the gold mining industry. It builds on the issues highlighted in the supply chain analysis section above and focuses specifically on Ghana's export potential of gold, seeking to appreciate through visualising the contribution and impact of the LSGM and ASSGM sub-sectors. Before comparing these two sub-sectors however, the researcher also considers it important to offer a BoT analysis of FDI in-flows as they are a key variable impacting on the industry.

The section also contributes more substantively to the purpose of this study through causal loop diagramming (CLD). It shows a small set of CLDs that frame and provide an alternative perspective of the problem situation - gold mining in Ghana. The rationale for the analysis in this section is provided by Maani and Cavana (2007), who recommend use of BoT and CLD analyses, combined with an appreciation of systems archetypes as one of the pathways for systems thinking related studies.

A CLD representation may also help to surface archetypical systemic structures, aka systems archetypes that are embedded within the wider system of relationships, cause-effect relationships and causal loops linked to Ghana's export potential of gold. By so doing, a CLD will provide a more structured approach for characterising the nature of systemic complexity, systemic dynamics, and systemic relationships in this situation.

A CLD will also help to create visual impressions about systems archetypes that are embedded in cause-effect relationships between variables that are linked to, particularly the Ghana's export potential of gold. By so doing, a CLD will provide a more structured approach for characterising the nature of systemic complexity, systemic dynamics and systemic relationships linked to Ghana's export potential of gold.

In particular, it is anticipated that CLM and the associated CLDs will help identify behaviours, relationships and systemic features of the situational context that shed light on key issues relating to the *export potential of gold* and allow for appreciation of fundamental problem and solution (leverage point) that if considered, would overcome the problem to enhance the ability of our gold mining industry to maximise outcome for the Ghanaian stakeholders of the industry.

It must be noted that there are various intermediary variables that are also important and interact with the *export potential of gold in Ghana*. However, they will unfold as the CLD diagram is developed. The analysis starts with BoT representation of key variables as follows.

5.4.1 Behaviour over time (BoT) of key variables

As indicated, a BoT of FDI in-flow is considered first. Following this, attention will be given to comparing the LSGM and ASSGM sub-sectors to understand the nature of the relationship between them in relation to Ghana's export potential of gold.

5.4.1.1 BoT of FDI in-flow

Figure 5.8 provides the behaviour over time (BoT) graph showing the dynamic behaviour of FDI in-flow into the mining sector over time from 2005 to 2019.

For example, the level of FDI in-flow fell steeply from 2005 to 2006 and struggled to attain the original level until in 2011 where it made a remarkable increase, reaching a peak by 2012 when it began to fall sharply again (almost down to the record lowest level attained in 2006). Two years later, the level of FDI in-flow picked up, reaching its record second highest in 2017, but went down in 2018 and began to pick up slowly but staying below the level attained in 2017.

The rise and fall of level of FDI in-flow is accompanied with high level of uncertainty and can potentially cause delays for project development if it constitutes a major source of funding for such projects.

To manage the risks, government can decide to reduce reliance on FDI-inflows. Alternatively, it can seek to overcome activities that are contributing to the lack of stable FDI-inflows. It would additionally be possible for government to more effectively address its need for funds for investment.

Figure 5.8: FDI in-flow from 2005 to 2019

5.4.1.2 BoT of export/product by LSGM and ASSGM

The BoT comparison of export/production between LSGM and ASSGM in Figure 5.9 shows an interesting pattern. It could be noted that an undesirable effect such as a fall in the production and export of the LSGM sector is often lessened by a rise in the export and production of the ASSGM sector and vice versa. For example, in 2016 where the LSGM sector reached its lowest level, the risk was offset by a rise in production by ASSGM sector. The reverse is also true for 2017.

In 2018, the results were spectacularly enormous for the ASSGM, reaching its highest ever production/export of 1,985, 600 ounces of gold, representing about 41% of annual output of the industry. However, the ASSGM sector faced a downward trend in 2019 while the LSGM sector offset this with its highest production of 2,986,837 ounces.

The BoT comparison reveals a complementary relationship between the LSGM sector and ASSGM sector. It suggests that we must look to support both sectors to succeed if we aim to capture and sustain benefits from the export potential of the sector.

However, the researcher gathered various evidence from the field study that suggest that support for the ASSGM sector is not given by either the government or the LSGM sector. Instead, the government expects the ASSGM sector to seek external support as reflected in the viewpoint attributed to an ASSGM operator with multiple concessions and seeking to work on a project (see section 4.4.2.5) in Chapter 4 as illustrated below:

*...as for the small scale, that is **purely reserved for only Ghanaians**, and basically the concession is 25 acres. But if you have a **larger concession**, let's say about 100 acres, i.e. 4 small scale concessions and you want to convert to large scale then you go to Minerals Commission to start a new process. As a Ghanaian, you will face so many challenges if you want to convert to large scale. It is **very capital intensive** as you will go through the same processes that the foreign investors will go through.*

*In my case, I had to get my own surveyor, geologist and mining consultants and workers for prospecting and lab assay, and all of these involve money. We have an institution like the **School of Mines – Tarkwa**, and the **Geological Survey Department** who can at least help when it comes to the surveying and other geological activities. But you know, they will only do it if you can pay, so it is the same thing.*

But the law allows us to get support from a foreign investor unlike the small-scale concession which is strictly for Ghanaians [CL04].

By encouraging the sector to look for external support instead of providing such support locally, the ASSGM sector seems to have found a solution that is working, at least for the operators. Thus foreigners are indirectly being encouraged to invest in the sector through legislations that allow for such actors to provide mine support services for the industry as a whole – the ASSGM sector is not excluded even though it is strictly reserved for Ghanaian investors (see *Regulation 2 (1): A-class support service provider* – Minerals and Mining (Support Services) Regulations, 2012 (L.I. 2174) covered under the literature review section in Chapter 2. Thus government may need to decide whether it would provide the needed support for ASSGM sector or continue to allow the sector to help itself illegally, using formal service support system made available to it by the government.

The above situation together with the issue of whether or not to rely on FDI-inflow are typical of situations that could be approached using an EC framework, considered later under section 5.5.

Figure 5.9: BoT graph of Ghana's exports of gold by sector

5.4.2 Causal loop modelling (CLM) and Causal loop diagrams (CLDs)

In the following sub-sections, the system of interest, the export potential of the gold mining sector is framed as a small set of CLDs, focussing on its sub-systems. The development of the initial CLDs resulted from the researcher's background in the industry and the literature rather than the group modelling process advocated by Maani and Cavana (2007). However, the final CLD benefited significantly from insights from other analytical frames also modified based on insight from the field study. Such insights evolved my initial understanding about issues linked to Ghana's export potential of gold and led to modifications to the initial CLD (see Appendix 7). Nevertheless, it must be noted that, individually, and as a set, the CLDs are meant to be indicative and illustrative rather than definitive and comprehensive. As such, the individual CLDs illustrate the representation of cause effect relationships, the dynamic nature of causal feedback loops that play out over time, and overall systemic structure.

We may also note that where individual sub-system CLDs (Figures 10 & 11) have variables in common, they can be combined to form more expansive CLDs (Figures 12 & 13). Although this process serves to illustrate the complexity of the overall problem situation's systemic structure in terms of the number of variables, their relationships and their interconnectedness, the researcher acknowledges that the CLDs here only point towards what may be a comprehensive representation of the wider gold mining system.

A narration of some of these loops is provided to demonstrate how to describe and explain the causal and feedback relationships. Figures 11 and 12 represent a synthesis of the sub-system loops and demonstrates overall systemic structure and the interaction between the loops that contributes to system-wide behaviours and outcomes.

In forming each CLD, we may start from a variable of interest, say a concrete activity that is capable of quantification, or a more abstract or qualitative need, and then consider both what may

be its cause(s) and what other variables may be its effect(s). For example, in Figure 10, we may start with *Government's need to fund investment for capital projects* and consider alternative action to meet that need, for instance, through *Government action to attract FDI funding* on the one hand, in the shorter term, and *building capacity/capability of domestic financial institutions in Ghana*, on the other hand, for the longer term.

Here, developing each CLD highlights a sub-set of interactions between the key variables that impact the export potential of the gold mining industry, and that contribute to an understanding of the emergent properties of variables in the mining system. Based on this, we may better understand what and/or why the system may not be doing well as well as desired, and whether, systems structures that resemble archetypical systems relationships and systemic structures may generate insights about how to address shortfalls in system performance.

The following two sub-sections present CLDs (Figures 10 & 11) of sub-systems seeking to capture the impact of alternative choices/actions, first, for addressing the *Government's need for investment funds for capital projects*, and then, in setting the *relative benefit to investors of FDI contractual terms for investment in gold mining*. Figure 5.12 then presents a synthesis of Figures 10 and 11.

5.4.2.1 CLD 1 – Understanding Choice relating to Government's need for investment funds for capital projects

This sub-section seeks to shed light on the impact of choices relating to meeting *Government's need for investment funds for capital projects*. It provides a CLD, Figure 5.10, comprising of two balancing loops – loop (B3) and loop (B4) that reflect how each of two Government actions may beneficially address that need and a reinforcing loop (R1). Each of these loops is annotated with a unique name reflective of its nature. In addition, all variables are uniquely identified.

We may narrate Loop B4 as follows:

the **greater** the *Government's need for investment funds for capital projects*; the **stronger the commitment** to *Government action to attract FDI to the mining sector*; and the **higher the Level of FDI funds for the development of export potential of gold in Ghana; and hence, the **lesser** the *Strain on government's ability to fund capital projects*. Note also that cause-effect relationships are represented by directed arcs with arrows that are annotated “S” or “O”. These annotations reflect positive (same direction) and negative (opposite direction) relationships, respectively. The following provides a **Legend** as a guide to properties outlined in the CLDs**

Legend: ‘S’: increasing (positive) effect; ‘O’: decreasing (negative) effect; ‘B’: Balancing loop; ‘R’ Reinforcing loop.

Figure 5.10: CLD1 - Understanding choice relating to *Government's need for investment funds for capital projects* – the Shifting the Burden systems archetype

5.4.2.2 Domestic funding loop B3

Interpreting the “S” and “O” annotations described above, the cause-effect relationships evident in the Domestic Funding loop B3 of Figure 5.10 can be narrated as follows:

The **greater** the *Government's need for investment funds for capital projects*, the **stronger the commitment** to *build capacity/capability of domestic financial institutions in Ghana*. In the event that government recognises *the need to build the capacity/capability of domestic financial institutions in Ghana*, this will over time, **intensify** actions it will take to *build capacity for domestic investment in Ghana*. Then, as government **intensifies** its actions to *build capacity for domestic investment in Ghana*, this has the potential to **increase** *Government legislative and budgetary support for institutions*, thus **lowering** the *Government's need for investment funds for capital projects over time* – and thus closing the *domestic funding* property loop B3 in a beneficial way.

In this case, being able to access and use domestic funds represents one longer-term solution for addressing or approaching the *need for investment funds* in Ghana. The next sub-section considers an alternative shorter-term solution – that of improving access to FDI funds.

5.4.2.3 FDI funding loop B4

The FDI Funding loop B4, shown in Figure 5.10 displays the causal relationships linking actions to *attract FDI funds to the mining sector* as a possible solution to the *Government's need for investment funds for capital projects*, to its perceived consequences and antecedents.

To convey understanding of these relationships, the loop B4 is narrated below:

The **greater** the *Government's need for investment funds for capital projects*, the **greater the boost** to *Government action to attract FDI funds to the mining sector*. By so doing, the *level of FDI funds for the development of the export potential of gold in Ghana* is **increased**, thereby **reducing** the *strain on government's ability to fund capital projects*, which, in turn, **softens** *Government's need for investment funds for capital projects* – closing the loop B4 in a beneficial way.

The above analysis has shown how the shorter-term FDI and longer-term Domestic Funding options (shown in loops B3 & B4) can each be beneficial. The CLD also shows that they are linked through a common variable which is the *government need for investment funds for capital projects*.

The next sub-section reveals how the options interact in an unexpected, unintended manner, which is referred to as *dependency on FDI funds* as depicted in the FDI dependency loop R1.

5.4.2.4 FDI dependency loop R1

The FDI Dependency loop R1 may be viewed as linking the outer set of variables in Figure 5.10. It facilitates an understanding of how one seemingly beneficial action can undermine or nullify an alternative action's attempts to create beneficial outcomes. We may narrate it as follows:

The **more intense** the *Government's need for investment funds for capital projects* has the effect of **boosting** *Government action to attract FDI funds to the mining sector*. By so doing the *level of FDI funds for the development of the export potential of gold in Ghana* is **increased**, which has the effect of **increasing** the *level of gold mining operations, raising foreign exchange earnings* – which appears quite desirable.

However, once *foreign exchange earnings* are realised, it may entrap us into **deepening commitment** to a **growing** *dependency on FDI funds for development of export potential of gold in Ghana*, thereby **growing** a *dependency on FDI funds for development of export potential of gold in Ghana*, **and hence, reducing** the *ability of government to focus on domestic economic development and undermining the capacity to build domestic investment in Ghana*.

In brief, the shorter-term *Government action to attract FDI funds to the mining sector* undermines the longer-term option to *build the capacity/capability of domestic financial institutions in Ghana*, and thus **undermines** the capacity to build domestic investment in Ghana. Continuing the narrative, we note:

... that **undermining** the capacity to build domestic investment in Ghana will **negatively** impact government legislative and budgetary support for domestic institutions, thus **intensifying** the Government's need for investment funds for capital projects – thus closing loop R1 as a vicious reinforcing loop.

This finding has implications for Government policy and decision-making, which will be further discussed in Chapter 6.

In particular, and by contrast, the *ability of government to focus on domestic economic development*, if encouraged, has the potential to build recognition of, and **stimulate** actions to *build capacity for domestic investment in Ghana*, leading to *necessary government legislative and budgetary support for domestic institutions*. This in turn **diminishes** government's need for investment funds for capital projects, over time.

In summary, while each of the balancing loops B3 & B4 indicate causal relationships and feedback loops that beneficially address *Government need* - in the short and longer term, respectively – the researcher notes, however, an unintended consequence of the shorter-term quick fix (B3). In particular, it can be noted that the **greater** the level of FDI funding for the export potential of mining in Ghana, the **greater** the dependency on FDI funds..., the **lesser** the ability of government to focus on domestic economic development, **undermining** longer term activities to build capacity for domestic investment.

The resulting systemic structure generated by the interaction between the three loops in Figure 5.10 is noted to be archetypical of a situation that Senge (1990) characterises as the *shifting of the burden* (StB) systems archetype. Identification of the StB structure here, suggests a problem situation that is common, and which reflects the tension or conflict between shorter-term quick fixes and longer-term fundamental actions or solutions to the stated need.

The StB is discussed further in Chapter 6. In this section, attention is focused on demonstrating the process of developing sub-system CLDs that build towards a comprehensive CLD, and how to narrate or verbalise the cause effect relationships that make up the causal loops in a CLD.

The next sub-section continues this process. It presents a CLD (Figure 5.11) of a sub-system seeking to reflect on the conflicting responses of Government and FDI Investors in seeking to influence the *relative benefit to investors of FDI contractual terms for investment in gold mining*. Subsequently, Figure 5.12 then presents a synthesis of Figures 10 and 11.

5.4.2.5 CLD 2 - Understanding choice in setting ‘the relative benefit to investors of FDI contractual terms for investment in gold mining

The problem situation is presented as a sub-systemic structure formed by the two balancing loops – loop B1 labelled as *FDI Intent* - and loop B2 labelled as *Government Intent* in Figure 5.11. The loops attempt to reflect conflict inherent in the intended actions of the FDI Investors and of the Government in Ghana.

We may narrate loop B1, *FDI Investors*, as follows:

The **lesser** the *relative benefit to FD investors of FDI contractual terms for investment in gold mining*, the **lesser** the *foreign investors’ commitment to FD Investment*, **reducing** the *level of FDI funds for the development of the export potential of gold in Ghana*, in turn **lessening** *foreign ownership and control of the mining sector*, **raising** *foreign investors’ perceptions of threats to the FDI environment*, **boosting** *FD investors’ actions to maintain FDI contractual terms* and eventually **raising** the *relative benefit to investors of FDI contractual terms for investment in gold mining* – thus closing the balancing loop B1.

We may similarly narrate loop B2, *Governement of Ghana*, as follows:

The **greater** the *relative benefit to investors of FDI contractual terms for investment in gold mining*, the **greater** the *strain on government’s ability to fund capital projects*, **increasing** *Government’s need for investment fund for capital projects*, and **strengthening** *Government’s actions to change FDI contractual terms*, thus *reducing on FDI contractual terms*, and **reducing** the *relative benefit to investors of FDI contractual terms for investment in gold mining* – thus closing the balancing loop B1.

Figure 5.11: Understanding choice in setting ‘the relative benefit to investors of FDI contractual terms for investment in gold mining’ - The escalation systems archetype

The resulting systemic structure generated by the interaction between the two loops in Figure 5.11 is noted to be akin to Senge's *Escalation* systems archetype (1990), where each party's behaviour and actions contribute to 'the figure of eight' systemic structure as a reinforcing loop maintaining the escalating conflict of actions or intent. In this respect, we refer to the reinforcing systemic structure as a vicious cycle leading to the escalating behaviours and increasingly dysfunctional outcomes that are associated with conflict.

We note in passing, however, that the same reinforcing systemic structure can give rise to a virtuous cycle of behaviours and desirable systems outcomes. As such, finding a path to such outcomes may provide a guide to resolving such conflict.

A discussion of the Escalation and Shifting the burden (StB) archetypes is considered in Chapter 6. The focus of this section is to create awareness of the existence of these systemic structures. Also note that the principles of verbalisation (narration) applied to the loops described previously also apply here.

5.4.2.6 CLD 3 – Combining Systemic Structures

The sub-system structures in Figures 10 and 11 share the common variables: *level of FDI funds for the development of the export potential of gold in Ghana*, and the *Government need for investment funds for capital projects*. Figure 5.12 shows the interconnectedness between those sub-systems.

We may therefore create a more expansive CLD, linking the two balancing loops B1 & B2 comprising the *escalation* sub-system (Figure 5.10) with the three loops, B3, B4 & R1, comprising the StB sub-system (Figure 5.11).

The extended CLD 3 (Figure 5.12) reflects the complexity already in the system, rather than increasing it. The complexity is related to the number of variables, causal relationships, causal loops, their embeddedness, and the overall connectedness between them. Here, we may note how the conflict captured in the *escalation* sub-system is now seen as an embedded sub-system within the conflict represented by the StB systemic structure.

By introducing the sub-systems first, the researcher has sought to assist readers to appreciate how complexity embedded in a CLD can be identified yet simplified by reflecting on the overall systemic interconnectedness as a meta-level connectedness between systems archetypes. As a corollary, we could aid understanding by decomposing a more comprehensive CLD into a set of other sub-systemic structures, which may include systems archetypes.

In other words, whilst we can decompose the CLD into individual relationships, causal loops groups of loops, we can also aggregate those same relationships and causal loops to the level of a systems archetype (Senge, 1990).

Doing the above action can then allow us to characterise the nature of relationships more effectively, communicate problems or complexity more effectively, and gain a higher level of understanding, knowledge and insight about the system.

Building on from Figure 5.12 below, the next section provides a complete picture of the final CLD following the addition of four more loops to those covered so far.

Figure 5.12: CLD 3 -StB and escalation systems archetypes combined

5.4.2.7 Putting it together – CLD 4

The researcher's initial desire to understand the effect that Ghana's export potential has on dynamics within the gold industry led to a curiosity to explore the effect that *Government action to attract FDI funds to the mining sector*, and to increase *foreign exchange earnings* might have on systemic behaviours within the industry.

Building on CLDs 1, 2 & 3, it was found that further variables needed to be beneficially added to develop a more comprehensive understanding about how relevant cause-effect relationships, causal loops and systemic structure underpinned and could inform the development of the export potential of gold in Ghana. An enhanced CLD 4 is provided in Figure 5.13 below. It shows the addition of a *domestic economy* loop (B5), and three reinforcing loops, namely: the *investment climate* loop (R2), the *national capacity* loop (R3), and the *Domestic Supply* loop (R4).

Analysis shows that *Government action to attract FDI funds to the mining sector* has the effect of **decreasing** *investment risk in gold mining in Ghana* as well as the positive effect it has on **increasing** the level of FDI funds for the development of the export potential of gold in Ghana. The enhanced CLD surfaces a complex situation relating to whether government action should focus on **attracting FDI funding** by **reducing** *investment risk in gold mining in Ghana* or whether Government action should avoid or **reduce** focus on *attracting FDI funding* to minimise risks of **growing** *dependency on FDI funds for development of export potential of gold in Ghana*

However, analysis shows that despite the risks of **intensifying** *a growing dependency on FDI funds for development of export potential of gold in Ghana*, there is a positive side effect of *Foreign exchange earnings* that is worth noting. For example:

Foreign exchange earnings impact positively by **increasing** the *allocation of foreign exchange funds to domestic economic development*. Such an **increased** *allocation ...* can contribute to other positive outcomes such as **decreasing** *Ghana's exposure to supply chain security/integrity risks associated with illegal ASSGM activities*, leading to an **increased ability** to *build capacity for domestic investment in Ghana*; **boosting** *investment in domestic supply chain and investment in the domestic supply sector*.

In summary, an interesting insight emerges from the CLD 4 presentation and analysis that relates to the nature of government focus on *foreign exchange earnings*. For whilst maintaining a focus on *foreign exchange earnings* can create benefit as stated above, not maintaining such a focus may avoid the risk of entrapment in the FDI dependency loop (R1). The dilemma faced by the government is that it appears to be in conflict about not being able to both maintain and not maintain focus at the same time. We note that whilst the CLM approach does not provide a means of resolving this dilemma/conflict, other systems approaches may do so. For example, the EC process of TOC has been developed to address problems/conflicts of this nature. The EC is thus considered relevant for the purpose of this study and its application will be demonstrated under section 5.5.

Figure 5.13: Indicative CLD of gold mining industry in Ghana

5.4.3 Key points from CLM analysis

As part of the CLM process, the researcher has applied BoT and CLD to analyse the gold mining industry from a systems thinking perspective. The process involved in developing the comprehensive CLD has been deliberately systematic and illustrative. Decision makers and other interested stakeholders of the industry may find the process relatively easy to replicate and use.

The section also identified systemic structures that are archetypical of the ‘shifting the burden’ systems archetype (Figure 5.10) and the “escalation” systems archetype (Figure 5.11). Discussion of these systemic structures is provided in Chapter 6 (see section 6.8).

It is worth noting that the presence of these archetypical structures, particularly the shifting the burden system archetype implies there is the need for change from a reliance on an external source, here a reliance on foreign capacity to focus on the development of local capacity. Indeed, the need for change is also evident from the field study with some participants expressing concerns about the export-driven model for value creation as illustrated below.

*...The point here is that the **model that we inherited from the colonial period is what we are following. We have not decided to change the model.** For instance, we mine in the country and export everything and import most of the inputs.*

*What will **remain** in our country **are few services** that some of our **local businesses** can provide, the **taxes** that the **government can collect**, and the **salaries paid to employees**.*

The chunk of the money will dissipate or leave the country through the importation of inputs, and exportation of output and significant profits are also repatriated [NL06].

Meanwhile, applying the CLD to understand the effect of Ghana’s export potential helped to capture complexity about cause-effect relationships linked to Ghana’s export potential of gold as well as raised issues that can be better understood through applying an EC approach.

Applying the EC approach allows the study to demonstrate an awareness of conflicts and that such issues can be thoroughly addressed by using the TOC thinking process (TP) tools.

An EC frame is considered next.

5.5 Evaporating cloud (EC) frame

To the extent that organisations are willing to challenge the assumptions that underlie these necessary conditions - either paradigms [i.e. external factors] or self-imposed [internal] policies, - great breakthroughs in systems performance are possible ((Dettmer, 2003, p. 62)

One of the main questions that we are seeking to address is to devise actionable solutions that if implemented could connect the gold mining industry to the desirable future (i.e. maximise outcomes or benefits for key stakeholders, namely: government, mining companies, and mining communities. Indeed, it was noted from the stakeholder analysis that there are different categories of actors that make up the stakeholders of the gold mining industry.

In this section, the analysis will focus on the seemingly disparate views collected from the government, mining companies, and mining communities as well as reflected from various analytical frames and use one of the TOC's thinking process tools, the evaporating cloud, to clearly depict the conflicts and dilemmas faced, and devise solutions. In doing so, we demonstrate the value of such an approach for resolving conflicts and dilemmas in other contexts.

The EC's main purpose lies in resolving conflict or dilemmas, and core problems underlying undesirable symptoms (often misconstrued for actual problems). Thus, unlike the supply chain/value chain analysis which made us to seek possible solutions by thinking in linear dimension about sequential operations; or CLD approach which led us to think in terms of cause-effect relationships, applying the EC necessarily forces us to think in terms of conflicts or dilemmas, using logic protocols.

An introduction to the EC framework was supplied in Chapter 3 (Figure 3.7). Following the helpful hints provided in this framework, the study will now turn to the main objectives of this section – applying the EC to the gold mining industry in Ghana.

The EC analytical approach allows this study to explore relevant concerns raised by participants during the field study, as well as the literature, for example where questions were raised about the best actions to take.

From a practical perspective, the use of an EC raises awareness and adds insights about complex situations such as the conflicts/dilemmas relating to whether or not to allow gold to be mined in forest reserves in Ghana as illustrated below:

*We have a large deposit of gold in forest reserves in Ghana. We need to preserve the forest, but we need to mine the gold as well. We asked the question; **how do we mine without compromising the need to preserve the forest for the future?** Out of about seventeen companies that had expressed interest to mine in forest reserves at the time, we selected only 5 for trial.*

*And then what we did was to **set up other guidelines for mining in the forest**. So, for example, if the gold occurs in a forest reserve, we know that we can only mine the gold where it occurs so there is nothing we can do about that one.*

Except for the pit, which we allow the companies to construct in the forest, we do not allow them to have offices/workshops in the forest as one of the principal guidelines.

Also, for every acre mined, a company is required to offset it by providing three times somewhere else, which means providing a new forest three times the size of the original during reclamation to compensate for every acre of the original forest mined [IE01a]

Theoretically, the need for an EC approach in this study can be justified by drawing on the two main approaches used by resource-endowed economies to maximise outcomes. The approach used by Ghana like others such as Canada and Australia based on the value capturing strategy focusing on the development of linkages (African Union, 2009) is one way of maximising desired outcomes from the gold mining sector whilst asset growth of a captured sector revenue-base through SWFs such as promoted by Norway (Alsweilem et al., 2015; Clark & Monk, 2010; Dixon & Monk, 2011), constitutes another key strategy. As emphasised by the Ghana Chamber of Mines (2019), Ghana can maximise outcomes from gold mining by in addition to harnessing the development of linkages, managing revenues from the sector more strategically. In such situation, an EC approach will frame the problem limiting desirable outcomes (that is the goal) from the gold mining industry in Ghana as a conflict between two necessary conditions involved. These necessary conditions are: "capture more value" on the one hand, and "grow revenues" from the sector on the other hand.

An EC approach can thus, help to create awareness about conflicts that are embedded in situations like the scenario above and allow the study to demonstrate that such conflicts could be addressed by breaking the underlying conflict. Some examples of conflicts embedded in the gold mining industry in Ghana, including where they originate, are provided below.

5.5.1 Where did the conflict come from

Table 5.10 provides a list of specific issues pertaining to the gold mining industry surfaced through the literature, field study or analysis thus far, that could benefit from the application of EC. From this list, three (3) ECs, one each for government, mining companies and mining communities, will be developed. A generic EC is then developed from the 3 ECs by finding common threads between the three sets of individual requirements and prerequisites.

Table 5.10: List of key conflicts and where they were identified

Specific Issue	Where surfaced						
	LitR	CRT	Field study	SA	SCA	CLM	conflict
Export potential of gold	yes	yes	yes	-	yes	yes	Focus on export verses local potential
Addressing the illegal ASSGM activities	yes	yes	yes	yes	-	-	Ban versus Don't Ban the Galamsey
Mining in forest reserves in Ghana	-	yes	yes	yes	-	-	Allow versus Don't Allow mining in forest reserves
Use of mine stability agreement (MSA)	-	-	yes	-	-	-	Limit versus Don't Limit the use of MSA
Managing perceived corporate tax avoidance	yes	yes	-	-	-	-	Be aggressive versus Don't be Aggressive
Mining permits/License for gold buying/export – ASSGM sector	-	yes	yes	-	-	-	Issue permit versus Do not Issue permit to individual Ghanaians
Level of government's involvement/ownership of mining industry	yes	-	yes	-	yes	yes	Maintain limited versus Don't Maintain limited involvement/ ownership
Minerals royalty fund	yes	-	yes	yes	-	-	Maintain the deal versus Cancel the deal
Achieve business goals	-	yes	yes	-	-	-	Pursue functional versus Do not pursue functional objectives.
Concern about community-company relationships	yes	yes	yes	yes	-	-	Support companies versus do not support companies.
Managing fiscal revenues from gold mining	-	-	-	-	-	yes	Prioritise domestic development versus prioritise building foreign reserves.
Increase ability to allocate funds to domestic economic development	-	-	-	-	-	yes	Maintain focus versus Change focus on foreign exchange earnings
Enhance competitiveness of gold mining industry	-	-	-	-	-	yes	Use attractive versus Do not use attractive FDI policies
Investment in ASSGM sector	yes	yes	yes	yes	yes	-	Reserve sector versus Don't reserve for Ghanaians.
Development of domestic capacity	yes	yes	yes	-	yes	yes	Focus supplier versus supply chain capability
Legend: LitR: Literature Review (LitR); Current Reality (CRT); Stakeholder Analysis (SA); Supply Chain Analysis (SCA); Causal Loop Modelling (CLM).							

5.5.2 EC analysis of national-level dilemma - Ghana's focus on export potential of gold

As hinted in the EC guidelines provided in Figure 3.7, the EC process starts with a storyline that provides sufficient detail of the specific case or situation at hand so that the EC can be constructed. The EC comprises an **objective** to be achieved, two fundamental **requirements** or **needs** that must be met to achieve the objective; and two **prerequisites** or '**wants**' for achieving the requirements. These 5 entities are placed in 5 boxes labelled A, B, C, D and D' as in Figure 3.8. Further guidelines are also provided there.

We can think of the objective as a *goal or a desire for the future*; the requirements as *needs that must be met now to achieve the desired future*; and the prerequisites as *preconditions* for achieving the needs. We structure the EC in such a way that B and C are both needed in order to achieve A. In order to achieve B, we must D, and to achieve C, we must D.' This creates a *conflict or dilemma* at the DD' arrow which must be resolved to fulfil both B and C, and hence A. The concept of conflict and dilemma is discussed further in Chapter 6 (see section 6.9.2).

Once the conflict or dilemma situation has been framed as an EC, we can apply necessary condition logic to surface assumptions and devise solutions (often termed 'injections').

The above process will apply in all the ECs analysed in this section, starting with the national level EC. But before proceeding to the EC process, the researcher considers it important to provide a context on which to base the storyline. Such a context can be provided by reflecting on participants' viewpoints from the field study that help understand how value is created on the one hand, and another viewpoint that helps to understand what improvement action(s) might be taken by government to maximise Ghana's value from the sector on the other hand.

A relevant insight from the field study reflects a view that government relies on the export potential of gold to maximise Ghana's benefits from the sector. One example of such concerns from the field study, captured under section 4.4.1.1, is given below:

*How we have developed our gold mining sector is not different from how the forerunners of the industry, our **colonial authorities**, ran the industry. The **purpose** was just to **produce the ore here, ship it abroad**, and then they will **add the value to it externally**.*

*The **Queen** was in control of Ghana, all the assets in the country belonged to her. So, what they did then was they mined the gold ore in Ghana, **exported raw gold out of the country, added value to it and paid a royalty to the Queen** because she was the owner of the resources at the time.*

*Of course, the government at the time also **used part of the revenue realised to develop the country**, in those days, the Gold Coast. We can point to **Kele-bu Teaching Hospital** and the **Achimota Hospital** as typical examples.*

*The point here is that the **model that we inherited from the colonial period is what we are [still] following**. We have not decided to change the model. For instance, we mine in the country and export everything and import most of the inputs.*

*What will **remain** in our country **are few services** that some of our **local businesses** can provide, the **taxes** that the **government** can collect, and the **salaries** paid to employees.*

*The **chunk of the money** will **dissipate** or leave the country **through the importation of inputs**, and **exportation of output** and **significant profits** are also **repatriated** [NL06]*

Supporting the above call for change, other participants from the study have voiced their concern about the reliance on the export potential, linking this to the inability of Ghana to develop the capacity of local Ghanaian suppliers, as illustrated below:

*In terms of statistics, about **90% of materials** are **bought from overseas** and about **10% from local sources**.*

*We are **not benefiting much from the sector**, and the reason is that our **local suppliers** rely on overseas suppliers.*

*So the 10% we source from local suppliers **end up coming from overseas** because we have **not developed the capacity** of our **local supply chains** to **independently supply** most inputs required by the gold industry locally [FL06]*

Similarly, other participants expressed concern about a growing reliance on foreign capacity linked to the reliance on export potential for value creation, attributing such issues to the collapse of local industries and limiting the ability of Ghana to maximise capture more value from the sector as illustrated below:

*Go to Tarkwa and you will be surprised to find that the **gold refinery** that was built by Dr Kwame Nkrumah is **abandoned and left to rot**. It has now **become a student hostel**. All the machines are left to rot.*

*There used to be a **company that produced Firestone Tyres**. Now Firestone is no longer produced in Ghana. As long as people are increasingly importing vehicles into the country, tyres will be needed.*

*Yet a company like that is left to rot? **We are talking about a factory which had got about 80% of the raw material in the country**. When Dr Kwame Nkrumah established the tyre factory, he additionally established **rubber plantations as a source of raw material**.*

*We have **sold most of these rubber farms** to **GREL** following **the collapse of the [Firestone] Tyre Company**. At least if not **machine tyres**, **light vehicle tyres** were being produced in Ghana, and that is where we were all bought our vehicle tyres from.*

*But now all **tyres are imported from overseas**. So, we have to **revive abandoned companies that have a link to the industry**, especially **those that do not depend on gold for raw materials** such as the **Firestone Tyres**.*

Probably the technology has changed, and so we may have to catch up, but it will not be like starting afresh [IE01c]

It could be noted, however, that; government is not insensitive to the adverse impacts that its budgetary reliance on the export potential of gold mining is having on its ability to maximise Ghana's value from the sector. We note from the literature review that government has decided to

take actions that will maximise the sector's value to Ghana through the development of policies that will strengthen upstream and downstream linkages (Ghana Chamber of Mines, 2018; Ghana News Agency, 2017) and the establishment of legislations aimed at protecting/increasing Ghana's fiscal revenues from the sector (Government of Ghana, 2019). These comments provide the basis for a storyline as part of the EC process, doing so from the perspective of the government. Such a storyline is illustrated below.

Storyline: *Government seeks to maximise Ghana's benefits from gold mining. It identifies attracting/encouraging FDI into LSGM sector is one of the key requirements (necessary condition) for achieving this goal through the export potential (export earnings) of the sector as this requires huge investment funds. At the same time, government recognises that the export earnings alone are inadequate for achieving the desired goal, and that it also needs to build Ghana's capacity (development of local industries). However, developing local capacity (as another necessary condition) also requires huge investment, and the government does not have enough funds to invest in both areas. Currently the government's solution to the problem of insufficient funds is encouraging foreign investment, specifically FDI in LSGM (i.e. focusing on the export potential).*

To start constructing the national-level EC, the researcher notes from the literature, and from information surfaced from the field study that one of the main objectives (desire) of government is to *maximise Ghana's benefits from gold mining*. We then identify two main requirements (Needs) that must be met to maximise Ghana's benefits from gold mining. The EC for above storyline is demonstrated as follows. The framework depicted in Chapter 3 (Figure 3.7) shows just the EC without the assumptions and injections.

To surface the assumptions, the EC diagram is read from left to right adding "because ... assumption" as follows (TOCICO Dictionary, 2012, p. 72).

i. In order to achieve A....,	we must do B...	because AB. Assumption
ii. In order to ensure B....,	we must do D...	because BD. Assumption
iii. In order to fulfil A....,	we must do C...	because AC. Assumption
iv. In order to have C....,	we must do D'...	because CD'. Assumption

Hence the conflict.

For example:

In order to achieve **A. Government must maximise Ghana's benefits from gold mining now and in the future**, **B. Government must attract FDI funds** because **AB. Neither the Government nor local firms/individuals have sufficient funds to invest in capital projects, so need foreign investors.**

Also, In order to ensure **B. Government must attract FDI funds**, **D. Government must focus on the export potential** because **BD. Historically, Ghana's best promoted export potential is gold, so FD Investors look mainly to gold for investment opportunities.**

On the other hand, in order to fulfil **A. Government must maximise Ghana's benefits from gold mining, now and in the future, C. Government must build domestic capacity/capability** because **AC. Domestic capacity/capability is currently lacking**.

Similarly, in order to have **C. Government must build domestic capacity/capability, D'. Government must focus on the local potential** because **CD'. Local industries linked to the gold mining industry are collapsing by focusing on the export potential**.

Hence the conflict.

Finally, for each assumption, one or more solutions (injections) are identified that if implemented would break the arrow, and hence resolve the conflict. Note that assumptions underlying Box A can also be shown per guidelines in Mabin et al. (2009). In the resulting EC diagram, Figure 5.14, the assumptions are shown in orange colour while the recommended solutions (injections) are highlighted green. The results (with detailed list of assumptions and injections) from the EC analysis are summarised in Table 5.11.

Figure 5.14: National-Level EC –The export versus local potential conflict

Table 5.11: Key Assumptions & Injections – export versus local potential

Key issue: Focus on export versus local potential		
	Key Assumptions:	Injections: What to change to:
A.	1) Maximising benefit from gold mining for present generations should not compromise the interest of future generations.	1) Government have understanding to prioritise interest without compromises.
AB	1) Neither the Government nor local firms/individuals have sufficient funds to invest in capital projects, so need foreign investors. 2) Government seeks to promote private sector development of mining industry. 3) Government mainly encourages local people into ASSGM sector for subsistence mining activities.	1) Government can start small and grow later, by investing available capital in medium scale projects. 2) Make it more attractive and easier for the people to invest in the sector. 3) Local investors from Ghana are encouraged/ supported to compete with FDI in LSGM sector.
BD	1) Focusing on the export potential of mining sector (gold) is the only way for Ghana to boost foreign investment. 2) Historically, Ghana's best promoted export potential is gold, so ... 3) FDI investors look mainly to gold mining for investment opportunities.	1) Gold is only one aspect; Ghana is also known for its export potential for agricultural produce (particularly Cocoa). 2) Ghana seeks to focus on the export of finished gold products, not just export potential. 3) Government decides to promote the potential of lesser known economic sectors in Ghana.
AC	1) Current capacity is so low. 2) Building domestic capacity/ capability is needed to sustain the benefits derived from gold mining, through circular production and consumption economy of gold.	1) Make better use of existing capacity, using methods like TOC (or TLS) to focus improvements. 2) Attitude, integrity and perception of people towards domestic institutions is very positive and can overcome capacity shortages. 3) Ghana recognises and ensures to pursue circular production and consumption economy now with existing resources
CD'	1) Local industries linked to the gold mining industry are collapsing by focusing on the export potential. 2) A focus on the local potential enhances Ghana's ability to build domestic capacity and capability for investment. 3) Benefits from the local potential will in the long run outweigh benefits from the export potential.	1) Local industries are strengthened by means of a supply chain/value chain approach, focusing on specific items. 2) Building domestic capacity/capability is possible by establishing an effective (public and private) financial sector to support local economic activities. 3) Government can utilise benefits from the export potential to facilitate development of the local potential.
DD'	1) Government considers it does not have sufficient funds to push both actions to the level they need.	1) Government would have sufficient funds for both if it exports more finished products from gold. 2) Government can safeguard both links by encouraging state-private sector partnership for funding for needed projects amongst Ghanaians.

5.5.3 EC analysis of conflict pertaining to LSGM sector

As with the case of the government considered above, the LSGM sector also faces situations that can benefit from an EC approach. The viewpoint, below, from the field study suggest that investing in gold mining constitute a risky endeavour for multinational LSGM companies.

The success rate of gold projects is between 3 and 5 per cent. That is the success rate globally, meaning a company can lose big. So, if companies take the risk, then they should be rewarded. Of course, companies can also win big if the project is successful...[NL04]

As another viewpoint implies, government policies such as a 15% VAT on exploration, and the ‘ring-fencing’ of projects, exacerbate the risk potential of the sector’s activities.

There are some policies such as VAT on exploration, which is discouraging exploration activities. It is just like killing the goose that lays the golden egg.

What makes it wrong is the fact that doing exploration is like sinking money on the ground, the outcome is unpredictable. It is very discouraging, to be honest.

It is like asking someone to pay 15% VAT on a dead body.

Apart from the 15% VAT, if the company has multiple projects like ours, for example, each of them must pay its taxes.

The problem is that if a company starts a new project, it means it is going to pay 15% VAT on exploration, and then in case the new project makes losses, the law does not allow us to transfer such losses to the other project to reduce the tax burden.

With so much uncertainties surrounding our operations, it is difficult to start a new project because we have no idea whether that project can produce enough to be profitable [FL05]

A further viewpoint suggests, there is pressure on such companies by stakeholders, including government, to deliver on the social dimension, adding to complexity.

As captured in Table 3.2, insight from the field study suggests that the mining industry in Ghana is largely driven by the traditional economic approach, allowing the sector to pursue functional objectives/prioritise economic goals. As reflected in the above viewpoints, however, the nature of complexity faced by the LSGM sector could better approached by means of a systems management approach. A systems managerial approach conflicts with the pursuit of functional objectives.

An EC approach can help to analyse and inform how the industry could approach the nature of complexity confronting it.

Again, a storyline is provided first as follows.

Storyline: *In order to achieve the business goal (make money, now and in the future), mining companies consider it critical to work within operating budget (**requirement**). However, on the other hand, they also find it necessary to protect against operational risks (**requirement**). Managers recognise the need to pursue the overall goal. However, they also justify and prioritise functional objectives.*

Applying the same approach as completed for Figure 5.14, an EC analysis of a situation relating to the LSGM sector can be provided in in Figure 5.15 and Table 5.12 as follows. Also, note that in the remaining analysis, the EC diagrams are provided – listing the AB....DD’ arrows whilst keeping all the assumptions and injections in Tables.

An EC analysis of the above storyline can be provided as follows.

Figure 5.15: LSGM sector EC – Functional versus no functional focus conflict

Table 5.12: Key Assumptions & Injections - Function versus no systems objectives

Conflict: Functional versus No Functional focus		
	Key Assumptions:	Injections: What to change to:
A	1) Making more money now and in future if the only way to stay in business.	1) Management have understanding to focus on the goal.
AB	1) LSGM companies lack control over conditions in the gold market (i.e., they are price takers) 2) Working within budget allows us to operate more responsibly – satisfy shareholders, meet tax obligations, fulfil environmental requirements and attend to CSR commitments.	1) Sector recognises that its market is not the constrained 2) Sector works responsibly in other ways (no longer expresses interest to mine in forest reserves) in Ghana.
BD	1) Sector believes in traditional management logic of management. 2) Traditional logic of management emphasises functional allows for focus on functional objectives... (FOL) 3) Functional control allows companies to be more efficient.	1) Sector decides to complement the traditional and systems logic management at the same time 2) Sector can spot external opportunities for operational efficiency within local supply chains. 3) Sector develops the ability to adapt faster than the business environment.
AC	1) Sector must operate effectively to be able to meet operational targets towards the goal. 2) Effective utilisation of factors of production (land, labour and capital) is critical – idle time is absolutely a waste – it must be avoided as much as possible.	1) Sector establishes and maintains trusted relationship for community support. 2) Managers are freed to focus on core managerial duties (including management of complexity, uncertainty and conflict).
CD'	1) Pursuing systems is objectives the best way to operate effectively. 2) Plant managers end up chasing purchasing department for parts under the functional approach, thereby slowing down the operations.	1) Managers are exposed to tools that allow them to capture/manage complexity associated with pursuing systems goals. 2) Plant managers can be allowed to place orders for critical items.
DD'	1) Managers can only follow one of these directives and must do so all the time.	1) Managers are encouraged to apply systems focus to issues for which systems goal is considered more appropriate and vice versa.

5.5.4 EC analysis of communities' support for ASSGM sector

So far, we have demonstrated the application of the EC to analyse conflict at the national and firm levels. To make our analysis more complete, it is important to add the voice of the community. Similar to the national and firm-level analyses, we provide a summary of the situation in a storyline, which informs the application of the EC to the situation as follows.

Following the same approach as with the national and firm level units of analysis, viewpoints captured at the community level reflect a concern about the lack of proactivity on the part of government. It also points to absence of agreed formal documentation such as an MOU, relating to government community-company relationships as illustrated below:

cry out or . They wait for us to

Moreover, we don't even have an MOU to guide our relationship with the mining company. So we make a request and the company may either respond to it or not.

Then we demonstrate before the government decides to act...[CL01]

The above concern can be coupled with the fact that the ASSGM sector is implicitly, if not formally legislated, reserved solely for Ghanaians and offers them more employment opportunities than the LSGM sector (McQuilken & Hilson, 2016). Nevertheless, the LSGM sector has the advantages of formalisation, CSR, and reduction in environmental consequences, more than the ASSGM sector.

Such a scenario puts mining communities in a conflicting situation where they must decide whether to give their support to LSGM sector to benefit from the advantages of formalisation projects or support for ASSGM activities for the employment prospect despite the environmental and human health risks. This situation can be analysed from an EC perspective, starting from a storyline as follows.

Storyline: *The main objective of mining communities is to achieve an improvement in overall wellbeing, now and in the future. On the one hand, they need a practical source of employment/household income, but on the other hand, mining communities need to ensure that adverse impacts of gold mining are mitigated. Communities have to date prioritised practical employment over the need to ensure minimum adverse impact, thereby supporting ASSGM as a practical source of employment for many community miners. The key issue thus is whether or not communities should maintain their support for ASSGM sector. An EC analysis of the above situation can be approached as follows:*

Figure 5.16: Community-Level EC – Support for ASSGM versus LSGM sector

Table 5.13: Key Assumptions & Injections – support for ASSGM versus LSGM sector conflict

Conflict: Support for ASSGM versus LSGM sector		
	Key Assumptions:	Injections: What to change to:
A	1) Overall wellbeing is needed both now and in the future.	1) Addressing issues like child poverty is another way to approach this issue.
AB	1) Practical sources of income in mining communities are not supported/remain underdeveloped. 2) Most people are unemployed. 3) Limited number of people can be employed by mining companies.	1) Alternative livelihood projects are managed to provide regular and competitive (relative earnings from mining employment) to the people.
BD	1) Sector is reserved specifically for the people. 2) ASSGM is good source of money for most Ghanaians.	1) Government decides to attract FDI into ASSGM sector. 2) Government needed support for development of ASSGM sector.
AC	1) Mining communities lack adequate provision of basic infrastructure. 2) Mining communities are highly exposed to adverse environmental consequences of mining activities in Ghana	1) Community share of Mineral Development Fund (MDF) is distributed/managed more effectively. 2) People are motivated and encouraged to report suspected environmental misconducts.
CD'	1) LSGM sector recognises the need to ensure the welfare of the people as part of its CSR efforts. 2) There are some evidence of infrastructural projects by LSGM sector with (without) government support. 3) Sector is obviously committed to fulfilling its social and environmental obligations (including compensation for adversely affected sources of livelihoods).	1) People are happy to support LSGM sector if company-community relationship is formalised. 2) Agree with people about CSR projects specifications, roles, mode of delivery, and commitment required by each stakeholder for success. 3) Everyone affected by mining activities is benefiting from the compensation scheme.
DD'	1) Communities cannot do both actions at the same time.	1) Communities support positive aspects and avoid negative features of both as much as possible. 2) Support ASSGM sector for more employment and support LSGM sector to facilitate development of social infrastructure.

5.5.5 Generic evaporating cloud

Drawing on the three (3) ECs completed above, we can develop a core conflict cloud (generic cloud) which will be used as the basis for the final CRT of this study. The 3-cloud method is described in (Cox, Blackstone, & Schleier, 2003; Mabin et al., 2017) Table 5.14 below summarises the individual ECs and the generic EC. Here, since the 3 individual ECs were at such different levels, grouping into common themes was difficult. The resulting GEC uses quite high levels of entities within which the others may be seen to be subsumed. Also note that current action has been placed in D, and the sides of the individual clouds have been swapped to suit.

Note that the Generic EC regarding the use of the ERSBA framework for tighter regulation is informed by participant viewpoints (*see section 4.2.1.1, Chapter 4 – NL01*). That participant viewpoint suggests that the ERSBA was established following lessons learned from the environmental misconduct of a LSGM company.

The use of the ERSBA therefore has implications that include forgoing the need to use a more favourable regulatory alternative, a situation that could benefit from being analysed from an EC analytical frame.

Hence, in addition to putting the individual ECs together, the DD' of the Generic EC is informed by the viewpoint coded with NL01 as referenced above.

Table 5.14: A summary of individual EC frames versus generic EC frame

Entities	Individual EC frames	Generic EC frame
A	<i>Ghana must:</i> A. Achieve maximum benefit from gold mining, now in the future.	<i>Ghana must:</i> A. Achieve economic development and poverty reduction from gold mining, now in the future.
	<i>Companies must:</i> A. Ultimately make more money, now and in the future.	
	<i>Communities must:</i> A. Improve overall wellbeing of mining communities, now and in the future.	
B	<i>Government needs to:</i> C. Develop local capacity/capability.	<i>Government needs to:</i> B. Improve impact (reduce negative impacts) of gold mining.
	<i>LSGM Companies must:</i> C. Ensure to be operationally effective.	
	<i>Communities must:</i> C. Ensure development of social infrastructure/ Avoid environmental degradation/pollution.	
C	<i>Government must:</i> B. Attract FDI Funds.	<i>Government needs to:</i> C. Provide a more competitive (favourable) business environment.
	<i>LSGM Companies need to:</i> B. Work within operating budget.	
	<i>Communities must:</i> B. Have a practical source of income and employment.	
D	<i>Government must:</i> D'. Focus on the local potential.	<i>Government wants:</i> D. Maintain tighter regulatory system (ERSBA).
	<i>LSGM Companies must:</i> D'. Not pursue functional objectives.	
	<i>Communities must:</i> D'. Prioritise support for LSGM instead of ASGM.	
D'	<i>Government must:</i> D. Focus on the export potential.	<i>Government wants:</i> D'. Provide a facilitative regulatory system.
	<i>LSGM Companies must:</i> D. Pursue functional objectives.	
	<i>Communities must:</i> D. Prioritise support for ASSGM instead of LSGM.	

Applying the same principles as before, analysis of the generic EC is provided in Figure 5.17 with a list of assumptions and corresponding injections in Table 5.14.

Note that objective A. *Government must maximise Ghana's benefits from gold mining, now and in the future* (Figure 5.14) is reframed to consider the broader picture (the ultimate objective that government is seeking to achieve) as shown in Figure 5.17 below. Also note that entity B. *government needs to improve impact (reduce negative impacts) of gold mining covers requirement*

B whilst C. *Government needs to provide competitive (favourable) business environment* reflects requirement C. These aspects are listed in Table 5.14 above.

Regarding prerequisite D. *Government must maintain tighter regulatory system (ERSBA)*, this takes care of the people aspect, in the previous ECs, particularly Figure 5.13 whilst D'. *Government must provide a facilitative regulatory system* represents consideration of the business dimension as it more specifically relates to Figure 5.12 for example.

Hence, although DD' is framed in relation to the lens of government it could possibly be looked at from the lenses of mining communities and companies as follows: D': **People** (in this case mining communities or Ghanaians, more broadly) **want** government to maintain tighter regulatory system on the one hand. On the other hand, D'. **Companies want** government to provide a facilitative regulatory system. Hence the conflict (i.e., DD').

As with the individual level ECs, requirements B and C are both needed (necessary conditions) in order for government to achieve objective A. *Ghana must achieve economic development and poverty reduction from gold mining, now and in the future*. Prerequisite D must be met to have requirement B whilst requirement C is achievable by meeting prerequisite D'. By implication, objective A is achievable only by breaking the core conflict (DD' in Figure 5.17) below.

However, this study notes that prerequisite D seems to be prioritised by government, suggesting that D' is currently not met. Consequently, from an EC perspective, achieving objective A can be quite challenging (if not absolutely impossible) in this regard.

A list of injections for overcoming managing the situation towards the desired goal are provided in Table 5.15 below.

Figure 5.17: Generic EC – tighter versus facilitative regulatory systems conflict

Table 5.15: Generic EC assumptions & injections environment EC

Conflict: Tighter versus facilitative (favourable environment) regulatory environment		
	Key Assumptions:	Injections: What to change to:
A	1) Achieving economic development and poverty reduction now and in the future is considered the ultimate goal of government	1) Government aligns Ghana's benefit from gold mining with economic development and poverty reduction goals of the country.
AB	1) The natural and social environments are exposed to risks 2) Ghana's remediation cost of mining increases. 3) Ghana's economic potential of the gold sector is not fully exploited	1) Government ensures to attract socially responsible mining companies through competitive tendering. 2) Government recognises in and addresses underlying factors giving rise to expenditure on remediation. 3) Government identifies and addresses leakages throughout the gold supply/value chain.
BD	1) Companies cannot be trusted to fulfil their environmental obligations without the ERSBA. 2) Regulators believe in the ERSBA as providing Regulatory solutions to the social and environmental aspects.	1) Companies are committed to their espoused intent of responsible mining 2) Decision makers understand/correctly identify problems and offer better solutions.
AC	1) Government encourages FDI into LSGM sector to address its lack of funds/boost foreign exchange 2) It is impossible to attract FDI without having a competitive business environment. 3) The ability of gov't to realise more economic gains depends on the ability of mining companies to realise their economic goals	1) Government ensures FDI goes to where support is needed most/urgently (not just LSGM sector). 3) Government allocates resources to boost Ghana's capacity/capability for domestic investment.
CD'	1) The ability of mining companies to realise their economic objectives is enhanced by having a favourable business environment. 2) Government uses aggressive fiscal policies (such as ring-fencing/VAT on exploration)	1) Government recognises the need to reward mining companies for investment risks. 2) Government decides to remove ring-fencing and VAT on exploration.
DD'	Government cannot do D and D' at the same time because there needs to be one policy for all times, all situations.	1) Both actions can be used if stakeholders agree to work together for the collective good. 2) Use the ERSBA as pathway to a more facilitative regulatory system - companies that fail the criteria can be made to leave whilst the more socially responsible ones remain. 3) Apply tighter regulation to address illegalities in ASSGM sector, and facilitative regulation for more formalised (LSGM) sector.

5.5.6 Key point from EC analysis

This section has demonstrated the application and value of the EC to decision making and problem solving in complex situations. It could be noted that the first individual EC (Figure 5.14) suggests that Government is currently approaching its goals based on its own interests (i.e., internal frame). The individual level EC of the LSGM sector (Figure 5.15) and that of mining communities (Figure 5.16) also suggests that currently each of these stakeholders are making decisions based on their internal frames.

The implication of each stakeholder pursuing their goal(s) based on internal frame is that it can limit the solutions needed for the complex reality of the situation at hand. As such, the tendency of one stakeholder blaming its problem on the other stakeholder can be high. This may not help the decision maker to see herself/himself as part of the problem and lead to actions that may not constitute a fundamental solution to the situation. As a consequence, the problem may be concealed and over time, reappear either in the same or a much bigger magnitude than before.

The Generic Cloud (Figure 5.17) created the awareness that complex situations can be resolved. It also demonstrated how to do this using the 3-cloud approach which allows for consideration of both internal and external frames. An EC perspective also indicates that the main issue limiting desirable outcomes of the gold mining industry may relate to the ERSBA framework in use by the industry – for analysing and managing the impact (adverse impact) of the sector's activities in Ghana.

A better understanding about how the ERSBA – a well-recognised regulatory framework – promoted by government for providing a regulatory solution to adverse impact of LSGM sector, could be gained by subjecting the generic EC to further analysis through a CRT approach. A CRT approach is thus considered next.

5.6 Developing CRT from 'Generic EC'

In a CRT, we postulate root causes (near the bottom) that we think are leading to the problematic symptoms or effects (undesirable effect, UDE) at the top of the diagram. Identifying the root causes can be approached using a top-down or bottom-up approach. A top-down approach may begin with an overall UDE as we demonstrated in the case of the provisional CRT of this study (Appendix 1). A bottom-up approach can be better suited where the CRT is developed from a GEC. Like with most of the TOC tools, numbering is used in text boxes to aid in identification of entities, particularly during verbalisation where necessary.

In this section, the researcher seeks to demonstrate the process of developing the final CRT of this study starting from the GEC. Where necessary, the notion of a focused current reality tree as promoted by Ronen and Pass (2008), will be applied for a more succinct discussion of relevant aspects of the resulting CRT. The process for developing a CRT from the study's GEC using a bottom-up approach (i.e., starting from entity A to DD' in the EC) is as follows.

5.6.1 Switching from the necessary condition logic of the EC to sufficiency logic of the CRT

Firstly, the generic EC is turned vertically with the '**A**' at the bottom and **DD**' facing up such as demonstrated in Figure 5.18 below. Secondly, switch from a *necessity-based logic of the EC* to a *sufficiency-based logic of CRT* and begin to surface underlying assumptions from '**A**' through B to D, and from A through C to D'. Also, restate the conflict in *sufficiency logic*. A sufficiency logic may follow an: (*If then*) logic as is demonstrated later in the section below.

We then continue to connect the UDEs until the overall undesirable (UDE) issue at the top is reached. In this case, the overall UDE identified at the top of the completed CRT read as: 245. *Benefits for Stakeholders (State, communities & investors) fall short of expectations*. Understanding of the key issues contributing to the overall UDE constitutes the main intent of applying the CRT. Hence, this aspect will be discussed in more detail in subsequent sections. Finally, validate the underlying logic using the concept of the categories of legitimate reservations (CLRs). Again, applying the CLRs is also demonstrated in appropriate section below.

Figure 5.18: The Generic EC Turned Vertically

5.6.1.1 Applying the sufficiency logic

The sufficiency ('If then') logic can be verbalised by reading from (in this case) the bottom-up as follows.

If A...then B...because (assumption); If B...then D...because (assumption).

Similarly, If A...then C...because (assumption); and If C...then D'...because (assumption).

Practical examples can be provided as follows, focusing on **AB** and **AC** in Figure 5.18.

Thus it can be noted that:

- a) **If (A).** Government wants to achieve economic development and poverty reduction from gold mining, now and in the future **then 21 (B).** Government needs to improve impact (reduce negative impacts) of gold mining, **because:**

Assumption: There are concerns about the impact of gold mining in Ghana. *Similarly:*

- b) **If 01 (A).** Government wants to achieve economic development and poverty reduction from gold mining, now and in the future **then 12 (C).** *Government needs to provide a more favourable business environment because:*

Assumption 02. The ability of government to realise more economic gains depends on the ability of mining companies to realise their economic goals; and

Assumption 03. The ability of mining companies to realise their economic goals is enhanced by having a more favourable business environment

5.6.1.2 Applying the CLRs to validate a CRT

Applying CLRs to validate CRT can be approached by deliberately questioning the completeness (sufficiency) or otherwise, and the validity of the cause-effect relationships that have been surfaced for entities within the CRT. In relation to Figure 5.18, applying the CLRs was approached by asking the key questions that follow:

- a) Do we have any doubts about whether the causes giving rise to entity 21(B). *Government needs to improve impact (reduce negative impacts) of gold mining* are sufficiently complete?
- b) Do we have any doubts about whether the causes giving rise to entity 12(C). *Government needs to provide a more favourable business environment* are sufficiently complete?
- c) Do we think any important variables or entities are missing that also contribute to the above cause-effect relationship?

Like the SA, or SCA, CLD or EC, the final CRT process benefitted from both the literature and practical insights from the field study to inform entities in the CRT. For example, following the provisional CRT, developed solely from literature plus the researcher's own experiences with the industry, participants were given the opportunity to voice their views about those entities in the provisional CRT. As covered later under the section 6.9.1, some of the viewpoints on the provisional CRT were not confirmed. For example, Entity 115 on the provisional CRT "*Shareholders' expectations are not met*" was not confirmed. Here, participants indicated that they were not able to confirm or deny given that they are not shareholders of the industry.

However, other viewpoints, on the provisional CRT, including Entity 140. *Benefits for stakeholders (State, communities & investors) fall short of expectations*, were confirmed by participants of the study. As described in section 4.3.2.2 for example, a representative voice of participants (NL05) suggests that Entity 140 is a general refrain by Ghanaian stakeholders of the industry, including government, multinational mining companies and mining communities.

The participant code is in the above paragraph.

Yet other viewpoints from the field study augmented the study, contributing to entities on the final CRT that were not initially captured on the provisional CRT. One example is Entity 171. *Key stakeholders (including mining communities) cannot guarantee their commitment and support*. Recall that this issue is captured in a viewpoint at the *community level* (section 4.2.2.5, Chapter 4

– *CL01*). As indicated, more details pertaining to entities on the transition from entities on the provisional CRT to the complexity captured by entities on the final CRT are discussed under section 6.2.1 in Chapter 6. Hence, in this chapter, attention is focused on the CRT process as discussed below.

5.6.2 Initial aspect of the resulting CRT

Applying the sufficiency logic and CLRs to Figure 5.18 and challenging the researcher's assumptions resulted in the additional entities colour-coded pink, gold, blue, red and green in Figure 5.19 below. It must be noted that those entities in green, and pink from A through BC to DD' represent the entities in the generic EC. Entities colour-coded red are *undesirable effects (UDEs)*. Those colour-coded blue are *preconditions* (i.e. they have no entities leading into them). They can be considered *auxiliary entities* (meaning, they support or are supported by other entities to make a logical sense otherwise they are necessary but not sufficient to cause an effect) from a CRT perspective.

Entity 'A'. (01 (A). *Government wants to achieve economic development and poverty reduction from gold mining, now and in the future*) met the above description for a precondition although it is not colour-coded blue. This is because entity 'A' is part of the original entities from the generic EC (made up of A through BC to DD'). However, unlike entity A, entities B, C, D and D' can be considered intermediate effects because they have other entities leading into them (meaning, they could have been colour-coded differently such as green but also as red where necessary).

This is also to suggest that an entity colour-coded red such as 11. *Each stakeholder prioritises their own interest* in Figure 5.18 can be considered an intermediate UDE as it has other entities leading into it. However, the entity coded yellow (i.e. 05. *There is no collective effort/industry is characterised by win-lose relationship among stakeholders* which is an UDE and has no other entity leading into it, represents a root cause.

Accordingly, entity 05 is considered a root cause contributing to significant issues affecting stakeholders of the gold mining industry in Ghana in the context of this study. Like a precondition, the root cause entity has no entity leading into it. But unlike the precondition, the root cause is sufficient to cause an effect with (without) an additional entity as will be illustrated in subsequent diagrams. The base of the CRT developed from the Generic EC is provided in Figure 5.19.

The researcher repeated the same process demonstrated above to surface assumptions for DD' (i.e., applying the sufficiency-based logic and the CLRs) until arriving at the overall UDE at the top of the CRT. As the resulting CRT is large and complex, the next section will cover some important aspects about the final CRT and how this could be distilled into a more focused version of the current reality tree.

Figure 5.19: Developing the base of the CRT from the Generic EC

5.6.3 Final CRT and the focused Current Reality Tree

Whilst it is important to present the final CRT in full, a few issues bear quick mentioning. One of these issues is that it looks complicated due to size and detail, both of linkages and text boxes, number of entities and connections as with the CLD. Readers may strain to read the whole CRT without breaking it down.

Hence, the researcher considered it necessary to break the final CRT into three (3) main parts to highlight aspects that relates specifically to the ASSGM sector, aspects that can be attributed to the LSGM sector, and finally, aspects that can be used to explain the overall UDE from a stakeholder management perspective.

In spite of the above plan, some of the individual diagrams may still lack sufficient clarity in the way that can be easily understood by some audience of the study (particularly those who have little or no prior background in TOC).

Thus it is necessary to precede the plan outlined above with focused discussion on some of the key issues that contribute to the overall UDE of this study. This can be achieved using the concept of the *focused Current Reality Tree (fCRT)* (Ronen and Pass, 2008, Ch. 8). Hence, completion of the fCRT will lead to discussions around entity 05: *There is no collective effort/industry is characterised by win-lose relationship among stakeholders*, the root cause highlighted in Figure 5.19 above and subsequently, to presentation of the 3 main sub-set of current reality trees that constitute the final CRT.

Another issue relates to verbalisation of the cause-effect relationship logic of the resulting CRT. As showed above, for some stakeholders, this platform may be the first time to learn about the CRT tool. The interest of such groups can be stimulated by supporting them to understand the logic of the CRT, possible through verbalising the underlying cause-effect relationships between entities captured by the CRT. This is provided by verbalising the cause-effect relationships in Figure 5.20, (i.e., fCRT 1) whilst referring to this and encouraging readers to apply the same process of verbalisation in subsequent sections.

Equally importantly, the final CRT provides the bigger picture. As its size prevents it from being readable on a printed A4 page, the final CRT is placed in Appendix 9. The fCRT is considered next.

5.6.5 Applying the focused Current Reality Tree approach

This section presents key aspects of the final CRT using the notion of the focused current reality tree as recommended by Ronen and Pass (2008). Following presentation of part 1 of the fCRT, verbalisation of cause-effect relationships in a CRT will be illustrated. Subsequently, part 2 and part 3 of the fCRT will be provided without verbalisation. Instead, focused discussions about key issues that are responsible for the overall UDE are discussed. Take note that not all entities at the bottom of CRT or fCRT may constitute a root cause as illustrated in Figure 5.19 above.

For example, entity: 122. *ASSGM mining activities involve use of unsafe production methods that endanger the environment*; 125. *Foreigners invest increasingly more in LSGM techniques illegally and reap untaxed profits*; 135. *Dealers sell gold to foreign buyers directly*, are at the bottom of Figure 5.20. However, they can be considered *preconditions* at this stage as these may have other entities leading into them. Hence, they are labelled *preconditions* and as such, should not be mistaken for *root causes*.

5.6.5.1 An indicative fCRT reflecting issues specific to the ASSGM sector

Figure 5.20: Indicative fCRT Part 1

Whilst presenting the CRT has taken a top-down approach, verbalisation will start from the bottom-up as follows using the sufficiency logic of the CRT. As illustrated before, this logic may involve: ‘If ...then or situations).

- For example, *If* 122. ASSGM mining activities involve use of unsafe production methods that endanger the environment *and* 125. Foreigners invest increasingly more in LSGM techniques illegally and reap untaxed profits, *then* 143. Environmental degradation and pollution associated with ASSGM gold mining in Ghana rises.
- Also, *If* 125. Foreigners invest increasingly more in LSGM techniques illegally and reap untaxed profits *then* 144. Leakages of profit to foreigners occurs.
- Similarly, *If* 125. Foreigners invest increasingly more in LSGM techniques illegally and reap untaxed profits *then* 183. There are unpaid taxes through ASSGM sector.
- Moreover, *If* 143. Environmental degradation and pollution associated with ASSGM gold mining in Ghana rises *then* 155. Remediation costs/risks through ASSGM supply chain increase.
- Also, *If* 144. Leakages of profit to foreigners occurs *then* 155. Remediation costs/risks through ASSGM supply chain increase.
- Furthermore, *If* 142. Gold leaks through supply/value chain of ASSGM sector *then* 155. Remediation costs/risks through ASSGM supply chain increase.
- As another complex situation for example, *If* 143. Environmental degradation and pollution associated with ASSGM gold mining in Ghana rises *and* 155. Remediation costs/risks through ASSGM supply chain increase *then* 173. Government feels pressured to ban most ASSGM activities.
- Moving up further, it could be noted that *If* 173. Government feels pressured to ban most ASSGM activities, *then* 182. ASSGM sector is not supported and remains underdeveloped.
- Now *If* 182. ASSGM sector is not supported and remains underdeveloped *then* 191. Ghana fails to realise potential benefits from ASSGM sector.
- Similarly, *If* 183. There are unpaid taxes through ASSGM sector, *then* 191. Ghana fails to realise potential benefits from ASSGM sector.
- It must be noted that *If* 142. Leakages of profit to foreigners occurs, *then* 191. Ghana fails to realise potential benefits from ASSGM sector. However, this link was deliberately omitted from Figure 5.20 as a way of supporting the study’s audience – the mining industry in Ghana – with a challenge to try out.
- And *If* 191. Ghana fails to realise potential benefits from ASSGM sector *then* 205. Ghana’s economic potential of gold mining sector is not fulfilled.

The above process can be applied to other parts of the final CRT to dig down to the underlying causes of undesirable effects (UDEs) that appear on the surface. An example of fCRT relating to benefits for stakeholders are supplied next.

5.6.5.3 An indicative fCRT linking the UDE to a precondition at the bottom

Figure 5.21: Indicative fCRT Part 2

Figure 5.22: Indicative fCRT part 3

5.6.7 Key insights from the application of fCRT

The focused current reality tree diagrams above illustrate cause-effect relationships between issues that contribute to the overall UDE: *215. Benefits for Stakeholders (State, communities & investors) fall short of expectations*. In Figure 5.21, it could be noted for example, that **If** 210. *Maximising benefits for stakeholders is absolutely impossible*, **then** 215. *Benefits for Stakeholders (State, communities & investors) fall short of expectations*. This cause-effect relationship is also reflected in Figure 5.22.

Note however, that Figure 5.21 and Figure 5.22 are focused on distinct aspects that contribute to the overall UDE. For example, Figure 5.22 focuses on key issues that give rise to: *205. Ghana's economic potential of gold mining sector is not fulfilled*. Of noteworthy amongst these issues is: *191. Ghana fails to realise potential benefits from ASSGM sector*. Recall that this issue was also captured in Figure 5.20 – that focused on specific issues relating to the ASSGM sector.

On the other hand, Figure 5.21 focuses on issues that give rise to: *201. Stakeholder value creation is not the main focus of the gold mining industry in Ghana*. For example, **If** 160. *There is no common goal to direct the priorities of key stakeholders* **then** 171. *Key stakeholders (including mining communities) cannot guarantee their commitment and support*. Also, **If** 171. *Key stakeholders (including mining communities) cannot guarantee their commitment and support* **then** 210. *Maximising benefits for stakeholders is absolutely impossible*.

5.6.7.1 The role of key stakeholders

Also note that whilst in Figure 5.21, only the government is captured as contributing to the issues that give rise to the overall UDE, Figure 5.22 captures the role of the LSGM sector to constitute another contributing factor. Figure 5.21 suggests for example, that: *150. Government uses aggressive fiscal policies (such as ring-fencing/VAT on exploration* and that: *173. Government feels pressured to ban most ASSGM activities*. These issues contribute to the overall UDE, making the role of government a key part of the ‘problem.’

Similarly, according to Figure 5.22, the LSGM may also be contributing to the issues limiting the ability of the industry to maximise benefit for stakeholders. As a key role for example, *80. LSGM sector expresses interest to mine in forest reserves with known economic prospect for ore deposits*. As another key role, *190. Employees of LSGM sector are faced with repeated episodes of redundancy*. Such issues, according to the analysis of this study, contribute to the UDE, thereby making the LSGM responsible.

Similarly, the role of other stakeholders for contributing to the overall UDE is outlined in Figure 5.20. Key amongst these stakeholders include Licensed gold dealers, the ASSGM sector and foreign investors in the sector. It could be noted for example: *135. Dealers sell gold to foreign buyers directly*. Also, *122. ASSGM mining activities involve use of unsafe production methods that endanger the environment*. Additionally, *125. Foreigners invest increasingly more in LSGM techniques illegally and reap untaxed profits*.

It can be noted that Figure 5.21 links the overall UDE to a *precondition* at the bottom: 140. *Capability of local economic activities linked to gold supply/value chain is not developed/not harnessed*. This means that it is possible to dig further down to the bottom of this entity 140 until a root cause is arrived at. Hence, in the context of this study, entity 140 is not considered a root cause. However, addressing entity 140 will enhance the ability of the industry to address the overall UDE. To address entity 140, it is important to trace it down the bottom of the CRT to the root cause(s).

Unlike Figure 5.21 however, Figure 5.22 links the overall UDE to an entity that can be considered a root cause, namely: 05. *There is no collective effort/industry is characterised by win-lose relationship among stakeholders*. This means that by addressing this issue, it is possible the gold mining industry in Ghana will be better able to address a significant number of the issues that give rise to the overall UDE. Addressing the root cause(s) captured in the final CRT is considered in Chapter 6, using the FRT (Appendix 9) to provide appropriate injections under section 6.9.4

Having discussed relevant aspects captured by the focused current reality trees in relation to the overall UDE: 215. *Benefits for Stakeholders (State, communities & investors) fall short of expectations*, the final CRT can be provided as shown in Appendix 1. The three parts constituting the final CRT are now captured below.

5.6.8 Breaking down the final CRT into the 3 main parts

The process of breaking down the final CRT into the three functional parts was approached with the help of the “Edit-Select all Successors-copy” function in the Flying Logic Software (McNally, n.d.), to test a range of entities at the bottom of the final CRT as follows. Thus the process also served as an opportunity to demonstrate how we can test for root cause (entities at the bottom of the CRT that we consider to be responsible for the overall UDE(s). as considered below, three main entities of interest are: entity 15, 63 and 05. However, the section starts by testing entities 01(A), 02 and 03 before the main entities of interest. Note that due to the size of the resulting CRTs, A3 size orientation is used. Hence, these CRTs (from Figure 5.23 – Figure 5.25), are provided following discussions on how the test was conducted as considered below.

Entity 01(A). *Government wants to achieve economic development and poverty reduction from gold mining, now and in the future* highlighted almost all entities on the final CRT (except for some aspects relating to the LSGM sector) as successors. These include key entities that are successors to the main entities imported from the generic EC (Figure 5.17), 12 (C). Government needs to provide a more favourable business environment; 21 (B). *Government needs to improve the impact (reduce negative impacts) of gold mining*; 25 (D'). *Government feels pressured to maintain a facilitative regulatory system for FDI in mining*; and 30 (D). *Government feels pressured to maintain tighter regulatory system*. Consequently entity 01 (A) can be considered a root cause.

Also, the same test was carried out on entity 02. *The ability of gov't to realise more economic gains depends on the ability of mining companies to realise their economic goals.* This highlighted a wide range of entities leading to the key UDEs on top of the final CRT similar to what was found for the test on entity 01(A). However, unlike it, the test on entity 02 did not capture entity 12 (C) and 25 (B) that came from the generic EC. It additionally did not capture key entities of interest for the purpose of this study as they relate to the LSGM sector, namely:

190. *Employees of LSGM sector are faced with repeated episodes of redundancy*; 180. *Mining companies struggle to achieve their economic goals*; and 172. *Operating cost of mining companies increases.* Hence, although entity 02 can also be considered a root cause to a significant number of UDEs, it may not be sufficient to overturn the overall UDE compared to entity 01(A) If this were to be the focus for injection.

However, both entity 01(A) and entity 02 are of little relevance for the purpose that is intended for this section (breaking down the CRT into standalone and easily to be read and understood).

The next sub-section considers entity 27 but first, entity 03 and 15 are tested.

Applying the same principle as above, entity 03. *The ability of mining companies to realise their economic objectives is enhanced by having a favourable business environment* was also tested. Here the test highlighted successors of entities in the CD' arrow imported from the Generic EC (Figure 5.17). These entities relate specifically to issues that pertain to the ASSGM sector. Also, the test was repeated for entity 15. *Government encourages FDI firms to address lack of funds for investment/boost foreign exchange earnings*, then 27. *FDI is attracted to LSGM sector in Ghana.* The results for entity 27 highlighted all successors that were also highlighted by entity 03 and entity 15 (with except the CD' arrow).

However, entity 27 also leads to a key entity on the final CRT that may need attention for improvement namely: 43. *No FDI goes to ASSGM sector.* This key entity was not highlighted by either test, using entity 03 and entity 15. Hence, for the purpose of this study, entity 27 can be considered an important issue that if addressed, could help to improve issues pertaining to the ASSGM sector instead of focusing only on entity 03 or entity 15. Upon further reflection, it was noted that: If 15. *Government encourages FDI firms to lack of funds for investment/boost foreign exchange earnings* then 27. *FDI is attracted to LSGM sector in Ghana.* Consequently, Figure 5.23 looks at the part of the final CRT that has entity 15 as a root cause (although this entity is treated a precondition on the main). The above situation gives rise to a growing dependency on the LSGM sector, consistent with the shifting the burden (StB) systems archetype as illustrated in Chapter 5 (Figure 5.10).

5.6.8.4 Testing successors linking entity 63 to the overall UDE

Further, applying the same test to entity 63. *Sector believes in traditional logic of management* highlighted all successors linking this entity to the overall UDE. These successor entities relate specifically to the LSGM sector, making it possible to pull this part out of the final CRT as Figure 5.24 below. In this case, entity 63 can be considered a root cause, particularly if the main interest is to address the LSGM sector in isolation.

5.6.8.5 Testing successors linking entity 05 to the overall UDE

Finally, entity 05. *There is no collective effort/industry is characterised by win-lose relationship among stakeholders* and entity 10. *There are concerns about the impact of gold mining in Ghana* were also tested. These were done in the context of establishing the root cause that can help to explain issues pertaining to stakeholders. Results from the initial test returned similar linkages for both, failing to capture key UDEs relating to stakeholders.

These include: 201. *Stakeholder value creation is not the main focus of the gold mining industry in Ghana* and 160. *There is no common goal to direct the priorities of key stakeholders* on the final CRT. It was later realised that these entities were not connected to the entity 05 even though they are successors. Consequently, the error was rectified as shown in (Figure 5.24) but the final to ensure that the numbering system on the final CRT (remained intact).

Hence, as was achieved for aspects pertaining to the ASSGM sector, and LSGM sector, entity 05 is considered the main the root cause of issues that help to explain the overall UDE from a stakeholder management perspective. This is shown in Figure 5.24.

Next, Figure 5.23 to 5.25 are now provided below. Note that these have been manually redrawn as the Flying Logic versions still looked unclear despite the breakdown. Also, the curved lines connecting two arrows indicate ‘and’. Additionally, dotted lines are used to illustrate feedback loops. It is worth noting here that TOC uses the terms “positive feedback loops” and negative feedback loops” differently from other systems-based methods. For example, the dotted lines in Figure 5.23 represent a feedback loop of cause-effect relationships within the mining system that would be described in mainstream systems thinking as a reinforcing loop or ‘positive feedback loop’, because the effect is being amplified.

However, in TOC this would be referred to as a ‘negative feedback loop’ because the situation is getting worse (and worse). To avoid using these terms in such a contrary manner, loops are referred to in this study as reinforcing and balancing, even in the context of TOC diagrams.

Finally, the diagrams may be viewed on A3-size portrait printouts. The complete (final CRT) is provided in Appendix 1.

Figure 5.24: Part 2 of final CRT – issues specific to LSGM sector

Figure 5.25: Part 3 of final CRT – Issues specific to stakeholders

5.6.9. Key points from CRT analysis

This section has demonstrated the development of the CRT from the Generic EC. In doing so, the logic validating processes of the CLRs and the sufficiency logic underpinning the CRT were explained, and cause-effect relationships verbalised. The section also demonstrated how the complexity embedded in the construction of CRT can be managed by using the focused CRT.

Finally, following the final CRT, this section has made it clear that the root cause limiting desirable outcomes of the gold mining industry in Ghana is that, there has been an absence of collective or collaborative effort amongst stakeholders as the industry environment is largely characterised by the presence of win-lose/zero-sum situations that impact relationships amongst stakeholders. The presence of win-lose/zero-sum thinking can be evident in Figure 5.24 where the sector's approach, reflecting the concept of "cost-world thinking" (Schrage et al., 2009) has resulted in emphasis on functional (instead of systems) focus. As a consequence, 180. *Mining companies struggle to achieve their economic goals* which leads to 190. *Employees of LSGM sector are faced with repeated episodes of redundancy*.

Similarly, it could be seen that 02. *The ability of gov't to realise more economic gains depends on the ability of mining companies to realise their economic gains*. Yet, government tends to use 150. *Aggressive fiscal policies (such as ring-fencing and VAT on exploration)* thereby intensifying 180. *Mining companies struggle to achieve their economic goals* and giving rise to 190. *Employees of LSGM sector are faced with repeated episodes of redundancy*.

As a consequence, 205. *Ghana's economic potential of gold mining is not realised*, and thereby reinforcing action 150. A similar situation occurs in relation to the management of the social and natural environment. For example, Figure 5.25 shows that 60. *Government prioritises the ERSBA framework for governing agreement with developers of LSGM sector* (multinational (FDI) mining companies) is reinforced by 160. *There is no common goal to guide the priorities of stakeholders* and the fact that 50. *Regulators believe in the ERSBA framework*.

On another key issue reflecting a reinforcing loop, it could be seen from Figure 5.23 that when 35. *Government prioritises the development of LSGM sector for FDI in Ghana*, 155. *Remediation costs/risks through ASSGM supply chain increases*, **intensifying** action 173. *Government feels pressured to ban most ASSGM activities* and constantly reinforcing action 35 and associated activities.

The researcher suggests that the sector may benefit from a reframing of industry structure, operations and objectives using the tools and protocols that characterise the GT, FRT and PRT processes and frames. In particular, the processes and frames related to the GT, FRT and PRT, in turn, can provide guidance to organisations seeking to design a desired future, design and validate possible solutions or actions to realise that future, and then manage the transition to that future. A GT is therefore considered next. The PRT and FRT will be considered later under appropriate sections in Chapter 6.

5.7 Designing the desired future using the goal tree (GT)

As summarised in the problem statement in section 4.5, the mining industry finds it increasingly more challenging to maximise benefit for stakeholders. Findings from the final CRT of this study suggest that the above issue is a result of win-lose relationships amongst stakeholders as each stakeholder prioritises their own interest.

Hence, following the structure of a goal tree outlined in Chapter 3 (Figure 3.5), the desired future of the gold mining industry in Ghana can be portrayed by specifying the goal, critical success factors (CSFs) and necessary conditions (NCs) that need to be fulfilled to achieve the goal. The provisional GT based on the literature is provided in Appendix 8. The GT was updated based on participant interview data and is provided below in Figure 5.26.

For example, a typical response is captured below. It points out the importance of cost competitiveness. It also implies that Ghanaian stakeholders of the gold mining industry, including government, multinational LSGM companies, and mining communities', express concerns about the source, level and distribution of benefits from the sector.

*You will get **government** saying that we **don't get enough** from the **mining companies**; you have the **community members** also saying the mining operations are **not impacting our lives** as we **expected**; and then you will hear companies also saying that the **cost environment** is too high for us and as a result we are also **unable to make profits in this country** and that we are **less competitive** when we operate in Ghana relative to... then they will mention a number of countries for you...[NL05]*

Details of the updated GT is discussed under section 6.9.3 in Chapter 6. While still only illustrative, it provides a benchmark/reference frame for testing proposed interventions through the future reality tree (FRT) and informs development of the implementation plan using the prerequisite tree (PRT).

Figure 5.26: Updated goal tree of gold mining industry – Ghana

Chapter 6 : Discussion

6.1 Introduction

This chapter discusses findings and insights surfaced in prior chapters of the study. It starts by restating the aims and objectives of the study, reflects on how these were approached, and summarises what the literature says is (are) the key ‘problem(s)’ of the industry. The chapter also outlines insights from the field study, and how the understanding of the problem situation and ‘problem(s)’ evolved following the application of the various frames in the multi-framing analysis. In the final section, the utility of the multi-framing analysis in the study is highlighted, and the value of multi-framing analytical approach is reflected on.

6.2 Aims/research questions and objectives

This study sought to develop a multi-framing, multi-level perspective for understanding the nature, structure and relationships that make up the gold mining industry in Ghana with a view to providing government, political and mining sector policy decision makers, and other interested actors with a platform for understanding of the sector in order to support their decision making about the industry and potentially improve outcomes for key stakeholders.

The study was intended to address identified research gaps, achieving the research objectives as follows:

1. Develop a comprehensive, multi-perspective description and understanding of the nature, structure and relationships that make up the gold mining industry in Ghana.
2. Identify root causes of significant problems facing the gold mining industry in Ghana and offer suggestions for possible alternatives that when implemented could help to overcome such problems.
3. Demonstrate the utility of complementary multiple systems thinking (ST) frameworks that can in due course provide government, political and mining sector policy decision makers with a better understanding of the sector in order to support their decision making not only strategically but also operationally and tactically, where necessary.

Specifically, the research set out to meet the above objectives via the following research questions.

- ❖ What is the nature, structure, and relationships that make up the gold mining industry in Ghana?
- ❖ How can decision makers logically analyse (identify and understand), and address significant problems limiting desirable outcomes for the industry?
- ❖ What is the utility of a multi-framing approach in providing a platform for decision making and problem solving about the industry?

6.3 The road to meeting the objectives of the study

The objectives were achieved by embracing a multi-framing analytical approach comprising of TOC analyses and complementary systems analytical perspectives, namely: stakeholder analysis (SA), supply chain analysis (SCA), and systems thinking (ST) using CLD modelling, with a critical realism ontological underpinning.

The rationale for the multi-framing approach draws on multimethodology, framing, and multi-framing, (Bolman & Deal, 1991; Mingers, 1997; Russo & Schoemaker, 1991), and particularly Davies and Mabin (2001b) who developed this approach for complex problems for which a single frame is deemed inadequate. They suggest that the approach requires that researchers/analysts must recognise the role of the study context, make explicit the nature of frames in-use, and promote the deliberate change of frames to consider complementary interpretations of complex problems.

By recognising the role of the study context (first, through review of the contextual literature) and subsequently providing a voice to stakeholders from the different parts and levels of the gold mining industry in Ghana, relevant insights about the study context and how various stakeholders conceive problems facing the industry were generated.

These insights enriched the researcher's understanding about the nature of issues faced by the industry and provided a basis for fuller analyses and better understanding of the resulting insights using the multi-framing analytical approach.

Before commencing discussion of the findings which indicate how the researcher's understanding about the sector's problem(s) evolved through the application of the multi-framing analytical approach, it is important to briefly highlight what the literature says is (are) the 'problem(s)' faced by the industry, and outline what was revealed as salient problems based on insights from the field study.

6.4 The 'problem' from the context of the literature

The contextual literature is replete with fragmented views and perspectives about what constitutes the 'problem(s)' of the gold mining industry, each depending on the nature of analytical frame, perspective and level of analysis, and each dominated by the use of limited-scope single-frame analyses.

For example, studies focusing on the community level (Garvin et al., 2009; Hira & Busumtwi-Sam, 2018; Taabazuing et al., 2012) often conceive issues facing the industry as those derived from the perceptions of community members and which in turn, emphasise adverse impacts of gold mining on the livelihoods of mining communities compared to benefits derived from the sector. According to such studies, the issues facing mining communities emanate from the lack of an effective governance or policy environment, arguing that the policy environment of mining is '*dysfunctional*', *that it favours LSGM companies to the detriment of protection for the interest of vulnerable stakeholders*, including for example, mining communities (Taabazuing et al., 2012).

Others relate this issue to the lack of *effective policy implementation*, including environmental polices (Tuokuu, 2019).

At the industry level, studies that focus on the LSGM sector identify the *lack of (cost) competitiveness* as a fundamental challenge facing mining companies (Atta, 2019). Others have attributed this issue to the *lack of a competitive/stable fiscal regime*, arguing that it exposes mining companies to investment risks and uncertainties that make it impossible for such companies to achieve their economic goals (Ayisi, 2015; Smith, 2016). Studies that examine the ASSGM sector emphasise its potential, a related lack of development of the ASSGM sector, and its ‘informal’ structure as major concerns. They blame the government for *prioritising development of LSGM sector* which according to such studies, have created opportunities for the illicit involvement of foreigners, particularly, ‘Chinese’ in the sector’s activities even though the sector is strictly reserved for Ghanaian investors.

Other studies have sought to analyse and understand the contribution that the industry makes to national economic development. Such studies have alluded to the contribution that Ghana derives from the export potential of its (gold) mining industry (Amponsah-Tawiah & Dartey-Baah, 2011; Aryee, 2001; ICMM, 2015). Nevertheless, it is suggested that some mining companies might be using measures counterproductive to the sector’s interests reflecting an *intent for tax avoidance* that make *effective implementation and administration of the fiscal regime challenging*, thereby depriving Ghana of potential revenues (Government of Ghana, 2019).

In a global context, and in relation to development and/or strengthening of indirect sector benefits, governments of resource-rich developing countries are being urged to capture more value from their resource sectors by strengthening backwards economic linkages (African Union, 2009). One of the key issues limiting the strengthening of linkages in a Ghanaian context relates to the *lack of capability of local Ghanaian suppliers to exploit full benefit from opportunities* through local activities and expenditure by LSGM companies (Ghana News Agency, 2017). Earlier studies such as Larsen et al. (2009) imply that generally, *FDI is characterised by a general lack of adequate linkages that could be capitalised on*.

By contrast, it is suggested that there are beneficial economic linkages and relationships that Ghana could capitalise on. However, the lack of *understanding of such linkages* remains a fundamental problem limiting the Ghanaian contribution that could be gained from the gold mining sector (Bloch & Owusu, 2012). This is supported by industry bodies such as the International Council on Mining and Metals which assert that attention should be *focused on improving local content procurement* to capture more benefit from the sector rather than focusing on *the direct contribution from such aspects as taxes and royalties* (ICMM, 2015).

In addition to *effectively managing economic activities, particularly revenues from the sector more effectively*, the Ghana Chamber of Mines has similarly emphasised the need to *harness linkage opportunities* arguing such harnessing has the potential to maximise the sector’s benefit not only to mining communities but to Ghana as a whole (Ghana Chamber of Mines, 2019). This view also

reflects an implied view and explicit recommendation by the Ghana Minerals Commission that problems, particularly, *environmental concerns from mining*, *an imbalanced distribution of mining benefits to stakeholders*, and *lack of integration of mining with other economic sectors*, should be addressed in a manner that maximises the sector's benefit to key stakeholders (Minerals Commission of Ghana, 2015).

From the global picture of mining of resources, Ghana is comparable to countries like Canada, Norway, and Australia amongst other resource-endowed economies that believe in the developmental potential of resources. Ghana recognises the contribution that mining can make, not only through macro processes such as the taxation link but also through micro processes (such as upstream/downstream linkages) that can directly contribute to development at community, district, and regional levels.

However, from the literature review, what Norway, Canada and Australia have done differently that remains a missing link in the case of Ghana, is that they have relatively low or no infrastructure/developmental deficit. This allows such mining and minerals resource-endowed advanced countries to manage revenues from these sectors more effectively/responsibly to the benefit of their economies and citizens through SWFs. Although Ghana manages revenues using SWFs linked to its oil sector (through the PRF), it is considered that the fund is characterised by a short-term focus and frequent withdrawals to address short-term capital needs of the government as an alternative to borrowed funds (see below link to an independent analysis of the PRF by CidiTalk³⁶). It suggests that longer term sustainability of the PRF, as the goal of the fund, is not guaranteed. It must be emphasised that the short-term focused approach by the government of Ghana is not limited to Ghana's petroleum sector, but also to the mining sector, through the MIIF covered under the literature review section of this study.

To a large extent, this study attributes this issue to the lack of adequate infrastructural development which paired with limited capital, put government under pressure to look for additional investment funds for infrastructural development of Ghana. Thus infrastructural development of the resource/mining sector is required to capture and sustain maximum potential from sector's investment as researchers at the McKinsey Global Institute imply (Dobbs et al., 2013). A well-developed infrastructure also makes it more feasible for resource-endowed countries to invest their natural wealth for future use, through for example, SWFs as in the case of Norway (Clark & Monk, 2010; Dixon & Monk, 2011). It additionally makes it possible to capture more value through the use of legal policies that allow for local processing of downstream and upstream value-adding activities as in the case of Canada and Australia (Fliess et al., 2017; Korinek & Ramdoo, 2017). In other words, the absence of a well-developed infrastructure makes it less practicable for resource-endowed economies to benefit from the full potential of wealth from the sector. In summary, Ghana's lack of adequate infrastructural development is the problem

³⁶ <https://www.ceditalk.com/2017/02/how-well-are-ghanas-petroleum-funds-performing/>

constraining its ability to realise maximum potential from the mining sector when considered from the global context of the industry.

6.5 The ‘Problem(s)’ as implied from viewpoints from the field study

By providing opportunity and voice to various stakeholders at different levels of the gold mining industry, enhanced insights were gained that improved the researcher’s understanding of issues surfacing from the literature as being symptomatic of underlying systemic problem(s) - that could be framed to reveal factors giving rise to ineffective managerial practices within the sector.

Three (3) key factors are the *difficulty to transition from theory to practice*; a *focus on local optima* (silo thinking); and *poor monitoring and evaluation culture* (sometimes called the ‘mission accomplished’ or ‘end-of-the-road-syndrome’). Such factors are embedded in the manner in which decision making and problem solving relating to analysis and management of the impacts of mining activities on key stakeholders is approached. Information gleaned from the field study provided the researcher with better understanding, knowledge and insights that helped to see the problems facing the industry differently than from the literature alone. Indeed, most of the issues highlighted by the contextual literature as ‘problems’ came to be viewed as symptoms of underlying causes instead of actual problems.

6.5.1 Difficulty to transition from theory to practice

Interview responses reveal an espoused desire by multinational LSGM companies and government alike to minimise adverse impacts and maximise the sector’s outcomes for key stakeholders, including those at the community level. However, the research has documented many instances of actions taken to address issues and improve outcomes that have instead resulted in unresolved dilemmas and paradoxes, preventing the desired outcomes for stakeholders.

Many of these paradoxes revolve around management of social and environmental impacts. For example, information from the field study reflects an ingrained commitment to CSR by LSGM companies to better the lives of their communities and to gain and/or maintain the social licence to operate. Information gathered from the field study additionally points to environmental regulation and compliance proactively built into the project approval system through the ERSBA framework and systematically monitored to minimise the adverse (and improve the) impact of gold mining in Ghana. The industry’s commitment to the social dimension as highlighted above is evidence of the recognition of indigenous peoples’ rights.

However, such recognition for the social dimension does not translate to actual outcomes for stakeholders. For example, to minimise the adverse impact of the industry’s activities on the livelihoods of host communities, compensation for adversely affected sources of livelihood is promoted by government and mining companies over other groups. Nevertheless, it was revealed from the field study that the *‘livelihood chain’ of stakeholders of mining communities is broken*. Indeed, the community livelihood compensation (CLC) scheme seems to benefit privileged stakeholders to the detriment of vulnerable stakeholders within the same community. Notable

amongst privileged stakeholders of mining communities may include Chiefs or traditional leaders of mining communities. Such stakeholders may have allodial title to lands and hence, can be considered as having power and influence in mining communities.

These non-landowner groups (including peasant farmers, and children), as stakeholders of mining communities, may therefore be less able to benefit from the sector's compensation scheme, as the compensation goes to the person who owns the land. This is because the scheme is generic, built into the project approval process through the ERSBA framework, failing to capture or reflect the complexity of stakeholders – in terms of the different ways in which different stakeholders experience the impact of the sector's activities. Consequently, information from the field study revealed that most peasant farmers (referred to as '*Abunu*' and '*Abusa*' farmers) do not benefit equitably from the compensation scheme despite having a stake in mining activities, because they do not own the land that they work on.

The same can be said about other 'vulnerable' stakeholder groups such as women and children. Indeed, it is viewed that the interest of children is generally overlooked during the development of mining projects in Ghana. The future success of children in mining communities is constrained by early exposure to mining activities which may lead to dropouts of most school teenagers in mining communities to engage in the relatively 'lucrative' Galamsey activities that parallel the development of major mining projects. Yet, children are not taken into consideration when compensating for adverse impact in mining communities.

In relation to women in mining communities, the patriarchal system/culture in most parts of Ghana is such that men have status as 'superior' to women and are considered to be heads of the family. They are also likely to benefit from employment opportunities in the mines whilst women may be left with responsibility for housekeeping, including looking after children. Such cultural differences have implications that include placing limitations on the ability of women to benefit equitably from mining activities and undermining their productive capacity and fundamental human rights.

Unsurprisingly, various women's associations linked to the industry, have been formed by women and by the industry as well, such as Women in Mining Ghana, Minerals Commission Ladies Group, Newmont Women and Allied Network, and Women in Mining Asanko. Whilst the existence of such women's associations ostensibly reflects an espoused recognition and promotion of the rights of women in mining and mining communities, the compensation scheme, in itself, does not address the imbalances related to gender in society nor does it take account of the impact of the sector's activities on women. Hence, women in mining communities are not compensated on an equal basis to their male counterparts.

Also noteworthy is the industry's seeming lack of consideration for the interest of future generations. For instance, whilst to present generations, maximising benefit from the sector could mean further exploitation of known ore deposits (ore reserves) as much as possible, to future generations, maximising benefit might mean keeping such reserves protected as much as is

feasible, and in a similar vein, for example, keeping forest reserves protected. Contrary to these views, the study revealed that gold mining in forest reserves is allowed, suggesting that the interest of future generations may be undermined in multiple interacting ways, and thus compromise the ability to maximise the sector's longer-term benefit.

Other pertinent issues surfaced in the field study are typical of the industry, including: *the economic and social wellbeing of indigenous mining communities which remain relatively poor* despite the sector's espoused interest in providing better conditions in such communities and improving the lives of the people living in them, and consequently; *the relative inability of the industry to guarantee the support of, and commitment to indigenous communities*; and more broadly, *Ghana's exposure to environmental and other supply chain security and integrity risks*.

The above concerns indicate that one of the key challenges limiting the achievement of desirable outcomes for stakeholders lies in the inability of policy makers, decision makers, managers and other key industry stakeholders to effectively transition from knowledge of the problems, and the theoretical and ideological positions that stakeholders hold and/or espouse, to appropriate practice, action and implementation.

The next sub-section provides commentary on why this may be the case and overviews a broad range of issues to be addressed.

6.5.2 Focus on local optima (silo thinking)

A focus on local optima (silo thinking) refers to a situation where different objectives are pursued by different stakeholders of a system (in this case, the gold mining system), each focusing on different priorities that may be deemed best for the performance of individual parts of the system or for satisfying individuals' stakes and interests. Evidence of a focus on local optima or silo thinking exists amongst stakeholders at various levels (including the national, industry, and business or firm levels) of the gold mining industry in Ghana and are often characterised by win-lose, arms-length relationships and compromises.

- ❖ At the national level for example, the government ultimately wants to gain full potential from gold mining as a springboard for economic development and poverty reduction in Ghana, but also prioritises major project development over development of local economic activities.
- ❖ At the industry level, annual sector performance depends on the distinct LSGM and artisanal ASSGM sub-sectors, each focusing on different paths towards the overall goal (where the two may not be able to co-exist). This 'conflict' then manifests to the extent that environmental regulation of these two sectors is not enacted with the same level of stringency. For example, tighter regulation of the large-scale gold mining sector is enacted through the ERSBA framework, but not so with the ASSGM sector.
- ❖ At the firm level, government wants to maximise revenues to the state (using aggressive fiscal and regulatory strategies) whilst mining companies seek to prioritise survival and other business goals, often compromising the interests of their committed and highly-skilled workforce, (particularly) during lean seasons of the industry where companies are

often faced with the need to reduce cost or improve cost effectiveness. Company focus on cost reduction can then often lead to the pursuit of narrow functional objectives at the firm and departmental levels.

Such a focus on local optima could give rise to the lack of consideration for systems goals and lead to situations where each stakeholder may prioritise their own interest to the detriment of others. This can make it challenging for effective execution of needed changes, affecting the performance of the entire system.

A number of factors have been identified as being responsible for these situations. Key amongst them are: *focus on short-term goals, poor monitoring and control of artisanal small-scale gold mining market, arms-length relationships amongst key stakeholders, and difficulty to transition from theory (espoused aims) of what the sector wants to achieve to practice.*

Thus on the one hand, for example, there is pressure to maintain the status quo but on the other hand, there is pressure to make wholesale change. How decision makers can manage to overcome this type of conflict using the evaporating cloud (EC) was demonstrated in section 5.5.

6.5.3 The mission accomplished, end-of-the-road syndrome

Another key issue that is evidenced by the viewpoints, but which might not be so obvious, relates to the lack of an effective monitoring and evaluation culture at different levels. The mission accomplished or *end-of-the-road-syndrome* as used in the context of this study relates to the sector's implied lack of a culture of continuous improvement. An effective continuous improvement culture will ensure that solutions such as the ERSBA framework be continuously reviewed for performance and updated to ensure its goal(s) are met.

Indeed, implementation of the ERSBA seeks to accomplish a mission for environmental rehabilitation and security by allowing regulators to hold developers accountable for their environmental activities prior to the project, which is laudable. However, evidence from the field study reveals that this allows for mining activities in forest reserves in Ghana, contributing to destruction of the environment and thus, constitutes a problem. It seems that regulators mainly believe in the ERSBA as providing a solution to environmental challenges facing the industry. Such a belief may have influenced their decisions to permit companies to mine in protected forests reserves. Such is the effect of the end-of-the-road-syndrome. Again, this has been analysed using the EC tool and will be revisited later in section 6.9.2.

Insights from the application of the various analytic frames are discussed next

6.6 Stakeholder Analysis Frame

In Chapter 5, the concept of the rational level stakeholder analysis was demonstrated and discussed in significant detail whilst clarifying and demonstrating relevant aspects about the notion of stakeholder dynamics that may need further discussions and elucidation. The researcher considered that the process and transactional-level stakeholder analysis would be better suited for discussions in this section to support assessment and discussions about how stakeholders are managed in practice relative to specific projects. This section discusses key findings from the

stakeholder analysis frame in Chapter 5, focusing on key stakeholders in the context of the Ghanaian government's *adoption of the UN SDGs*; its establishment of the *Minerals Income Investment Fund*; and its *ban on Galamsey activities*. This leads to a discussion of how well the gold mining industry in Ghana understands its stakeholder map in specific projects, the nature and processes for managing relationships with key stakeholders.

6.6.1 An implied recognition for women

It could be noted that one of the key priorities of the government of Ghana is its commitment to the *UN sustainable development goals* agenda addressing issues such as gender equality, particularly the rights of women, is emphasised.

Results from the dynamic level stakeholder analysis (Figure 5.3) shows that as a result of the adoption of the *UN SDGs* by Ghana, stakeholders such as *Women in Mining Ghana* is accorded status through the *United Nations Global Compact* as a *Pan-Governmental worldwide Organisation* to engage with and seek to influence the *Government of Ghana*.

As shown in Table 5.1, an awareness and recognition of women's rights and women's interests is implied through representation of the *Minerals Commission Ladies Association* at the industry level. Similarly, at the firm level, recognition of women's rights and interests is evidenced by the establishment of company-specific women's associations by some mining companies, including the *Newmont Women and Allied Network*; *Women in Mining Asanko*; *Manganese Ladies*.

Recognition of the importance of women's rights is reflected in the position of the *Women in Mining Ghana* on the stakeholder grid, identifying the organisation as *influencers* with *Formal/Legal Power* alongside other more traditional powerbroker stakeholders such as the *Ministry of Lands and Minerals Resources* and even the *Parliament of Ghana* and (Table 5.8).

These findings have implications for how stakeholder analysis of the gold mining industry in Ghana should be approached, and how the industry should manage relationships with key stakeholders, particular vulnerable stakeholders such as women. For instance, a revamped approach suggests value in moving beyond analysis confined to higher level or generic stakeholders to conducting analysis of the stakes, interests, and power/legitimacy/urgency attributes of specific stakeholders.

In related fashion, findings also suggest benefit exists when decision makers are prepared to overcome the tendency to develop solutions targeting generic stakeholders, or the perceived generic needs of specific stakeholders, and provide alternatives that are based on the stakes and interests, needs, and wishes of specific stakeholders. Drawing on Elias et al. (2002), the ability of the gold mining industry in Ghana to provide such specific responses or solutions to stakeholder needs depends on the *stakeholder management capability* of industry decision makers and managers. They suggest that stakeholder management capability can be assessed by addressing three key questions relative to specific projects. These are the question of *whether or not management understands the stakeholder map*, *whether or not there is a well-structured*

consultative process, and finally, *whether or not there is a transactional relationship between managers and key stakeholders* – the questions reflecting rational, process and transactional level stakeholder analysis respectively. Understanding the stakeholder map relates to the rational-level stakeholder analysis addressed in Chapter 5.

Field work provided the researcher with limited information to draw objective conclusions regarding the stakeholder management capability of the industry in isolation. However, capability could be deduced from the findings of prior studies (Famiyeh, 2017) suggesting that management seems to have limited understanding of the complexity embedded in the stakeholder map of the sector. This limited understanding can impair decision-making processes and indeed, adversely impact on the nature of relationships with stakeholders of the industry. Some practical implications are discussed below.

6.6.2 Practical implications for limited understanding of stakeholder maps

The practical implication of not having a better understanding of the stakeholder map can be understood by examining the nature of processes and transactions observed in the management of three projects that have relevance for this study. These are the *establishment of the Mineral Income Investment Fund*, the *Ban on Galamsey Activities*, and the *Community Livelihood Compensation Scheme*.

6.6.2.1 Establishment of the Minerals Income Investment Fund

With regard to the *Minerals Income Investment Fund*, the process leading to its establishment has been keenly criticised for *lacking transparency* and *proper consultation with stakeholders* by a range of stakeholders, including political leaders such as the former President and leader of the main opposition party – the *National Democratic Congress* – who has threatened to cancel the contract should their party be elected to office in the future.

A range of other stakeholders with similar concerns, including the *Imani Centre for Policy & Education*, the *Institute for Democratic Governance*, the *Public Interest and Accountability Committee*, the *Centre for Democratic Development*, *Ghana Transparency Industry Initiative* and the *Centre for Public Interest Law* have also joined forces against the initiative.

In addition to lack of proper consultation, these stakeholders suggest that the fund is inappropriate and constitutes risks for the future prospect of Ghana's minerals royalties. These are key stakeholders of the gold mining industry according to the analysis of this study (Table 5.1). However, as discussed above, their involvement in the establishment of the MIIF was clearly not encouraged by decision makers and hence, their prior concerns had not been addressed.

Besides *Political Parties* and *Social Cause Moments* as discussed above, the *Stakeholder Map* for the *Minerals Income Investment Fund* (MIIF) as a project may necessarily include others such as *Mid-Tier and Major Mining Companies* (Table 5.1). They have *Economic Stakes* that at minimum, relate to royalty payments to the State, and which would include their capital investments, sunk

costs, profitability..., which could be affected by requirements and operations of the MIIF. Hence, their *Economic Stakes* could be compromised. However, there is no evidence of their involvement and support for the MIIF. These are key issues from a stakeholder management perspective.

6.6.2.2 Ban on Galamsey

In relation to the *Ban on Galamsey*, the researcher notes that *Galamsey Operators* are also key stakeholders of the gold mining industry especially given their relationship with, and impact on a wide range of specific *Mining Communities* within the generic stakeholder *Affected Communities* category (Table 5.1). Increasingly, the activities of *Galamsey Operators* as informal, uncoordinated, and fragmented groups, operating outside any framework of regulatory requirements, have and are threatening the natural environment with water and land pollution (section 4.4.2.2).

It is not surprising that the activities of such *Galamsey Operators* were banned in 2017 (Hilson, 2017). The responsibility of curtailing *Galamsey* operations was given to new *Government Task Forces*, namely: the *Inter-Ministerial Committee on Illegal Mining* and *Operation Vanguard* under the *State Powers & Government Organisations* category in Table 5.1.

However, during the field study in 2019, the researcher noted that *Galamsey* activities were still ongoing, suggesting that the approach may have failed. Confidential information from the study's participants suggested a view that even though the *sector lacks formal recognition*, it may be surviving based on the support and involvement of *people with formal power and influence* in Ghana. This includes political figures and some *Chiefs of Mining Communities*, making the *Galamsey* issue difficult, if not impossible, to deal with.

As stakeholders, *Galamsey Operators* accrued Legitimacy as members of the *Mining Communities* grouping, to operate using artisanal means. These *Operators* also exhibited the attribute of Urgency in the sense that they could often act quickly and coercively, for example, to encroach upon the legally acquired concessions by *Minor, Mid-Tier & Major Mining Companies*, and in a sense, demanding a response. Such encroachments may also result in similar *operational conflict* between the *LSGM* sector and *Galamsey operators as well as the ASSGM sector*, thereby attracting the attention and intervention of the Government of Ghana. As Hilson and Yakovleva (2007) implied for example, operational conflict between *Golden Star Resources Limited* and *Galamsey Operators* in the *Prestea Mining Community* left the Government thinking about whether or not to pressure mining companies in the *LSGM* sector to relinquish some concessions for *Galamsey operators*.

With respect to *Power* and *Legitimacy* attributes, *Galamsey Operators* can be considered to have the informal support and backing of most members of local mining communities in Ghana. According to viewpoints gathered from the researcher's field study, the *ASSGM* sector, including the *Galamsey* sector, constitutes the best prospect for employment income and livelihood for these mining communities' stakeholders, Supporting the *Galamsey* sector's activities is thus, considered

the best way to protect and preserve the benefits derived from the sector for the economic wellbeing of most members of *Mining Communities* and their households.

Insights from the field study additionally suggest that *Galamsey Operators* may have the support of powerful individuals from different spheres of society, spanning *tribal chiefs, politicians* and *licensed gold dealers* who act as collaborators for personal gain. Such support is coupled with the involvement of collaborators, external to the communities, who often appear through *formal service support channels* to take opportunity to contribute to the sector by illegally investing and funding the transformation of labour-intensive artisanal Galamsey operations into more efficient and cost-effective mechanised alternatives.

Such support can be considered as increasing the *Economic Power* of the Galamsey sector, albeit in a negative way. The illicit mechanisation of the sector also increases the negative impact of Galamsey activities in Ghana significantly. While the *Ban on Galamsey* legislation was put in place to address the Galamsey problem, the legislation remains meaningless without addressing the factors spawning and/or facilitating Galamsey activities. These include the *issue of service support channels*, the *licensing of gold dealers to buy gold from the ASSGM sector (including Galamsey)*, the *political environment* and the *community support for the sector*.

This study's findings suggest that the *Ban on Galamsey activities*, at best, reduced operations for a while. The activities of the sector have since resurfaced, gaining more momentum, and involving the use of more mechanised mining methods and technologies than the traditional labour-intensive artisanal methods allowed by government. It seems that Galamsey, in the wider sense, has thus, grown to become more complex than is understood by the actions of government. Addressing the challenges posed by the sector, from a stakeholder management perspective, requires a more meaningful stakeholder consultation process and an enlightened transactional approach with key stakeholders. Again, it seems that stakeholder mapping relating to the stakes, interests, attributes, and dynamics of stakeholders of the Galamsey sector, is not well-understood, making meaningful interaction with the sector less likely.

6.6.2.3 Community Livelihood Compensation (CLC)

Drawing from participant viewpoints from the field study, *compensation for adversely affected sources of livelihood* in *Mining Communities* is a key aspect of the gold mining industry in Ghana. However, the 'what and how' decisions of compensation seem to be largely centralised at the national level (section 4.4.2.1), leaving little room for meaningful engagement and consultation with key stakeholders. The following viewpoint stated in section (4.2.2.5) is revisited here to illustrate how members of mining communities express some concerns about the nature of engagement and the impact on the nature of their relationship with mining companies.

'Sometimes we do not even know whether the government is involved. Because, if the government is involved, let us say we need a school building or other facilities, at least we should see government officials in the community, but we do not see them.'

*All the time if we are complaining about livelihood issues and others, the **Agric (Agricultural) officers**, or **Ministry of Trade and Industry** is not coming here.*

*When we go to the district, the **Works Department** is not coming here, even to ask or assess what are the things that we lack in our communities.*

Thus, we do not see the proactiveness of the government here at all. They wait for us to cry out or raise a red flag before [they] come in.

*Moreover, **we do not even have an MOU to guide our relationship with the mining company**. So we make a request and **the company** may either respond to it or not. Then **we demonstrate before the government decides to act**.*

So the communities and government should come together and bring the mining companies on board so that we all discuss and know the way forward and how best to get there. '[CL01]

In the absence of effectively engaging members of the mining communities in the process of determining compensation, the stakes, and interests of specific stakeholders in mining communities will not be well understood. As a consequence, important decisions about the 'how and what' of compensation will be made based on limited understanding of specific mining community stakeholders as individuals and groups. This may result in a situation where stakeholders may benefit differentially from the scheme, and possibly to the detriment of other stakeholders. Again, this issue can be illustrated using a viewpoint surfaced from the national level as follows.

*The **land tenure system** here is different; most of the natives are not farmers themselves. They may have leased their land on '**abunu**' or '**abusa**' basis, to a resident farmer who may not be a native member of the community.*

*When a **mining company** arrives, usually **government acquire the land** through the state as a concession and assign it to the mining company.*

The mining company must, by law, compensate the people occupying the land who may be affected by the project.

*[In this] case the land may have been leased on '**abunu**' or '**abusa**' to the occupant **by the owner of the land, mostly the chief**.*

*This occupant may have also shared the same land with a **tenant farmer** on the same basis, making it a complicated chain.*

*In this case, when **the company compensates the occupant farmer**, he or she must also **compensate the owner of the land**. [But] **the tenant farmer is often not taken care of by the occupant**. As a result, **the livelihood chain breaks**. That is a key challenge we are facing as regulators. It is a grey area we have not been able to tackle [NL03b]*

The foregoing discussions about each of the projects considered in this section lead to insights that can help to tentatively determine the stakeholder management capability of management of the industry as considered below.

6.6.3 Stakeholder management capability in the context of the MIIF

The researcher notes that mining companies and Government are not insensitive to the adverse impact of mining activities on the environment of mining communities or their stakeholders. As such, they have explicitly incorporated a framework for assessing harm or distress within communities that trigger compensation into the approval process for mining projects and have indicated commitment to implementing the process. Furthermore, there is evidence that, Government is concerned about the adverse impact of Galamsey activities and seeks to address the challenge of responding to it. It could additionally be noted that Government is neither insensitive to the imperative of managing revenues effectively to maximise Ghana's benefit from the gold mining industry in Ghana, as recommended by the Ghana Chamber of Mines (2019).

In summary, the researcher notes the commonality of limitations in the decision-making processes leading to the *'how and what' to compensate for adversely affected sources of livelihood*; the *Ban on the Galamsey*; the establishment of the *Minerals Income Investment Fund*. In all cases, they reveal management's lack of appropriate consideration of mapping the wider stakeholder ecology, the absence of meaningful and empathetic engagement processes, and little evidence of effective and enlightened transactional relationships with stakeholders. The findings of are consistent with those of Elias et al. (2002).

As such, the researcher considers that the stakeholder management capability of decision makers has scope for enhancement across the wider gold mining industry, spanning government organisations and mining companies consistent with Elias et al. (2002). Key findings from the supply chain analysis frame are considered next.

6.7 The Supply Chain Analysis (SCA) Frame

Supply Chain is like nature, it is all around us - Dave Waters

The supply chain analysis (SCA) frame was described and presented in Chapter 5 (Figure 5.4). Its application was demonstrated using specific situations relating to the “gold ore” value chain, the “tyre” supply chain, and the “gold” supply chain. This section discusses key findings from these analyses and practical implications. Some interim suggestions will be made for improvement. The discussion begins by revisiting the notions of value chain and supply chain.

6.7.1 Value chain (VC) versus supply chain (SC)

The twin notions of value chain and supply chain were clarified for the purpose of this study, noting that they differ only in terms of the nature and breadth of analysis. Otherwise, the researcher considers that they should not be treated separately. Instead, the value chain could be more appropriately be considered a sub-set of the supply chain. For example, we may appropriately refer to the value chain of raw materials – and that value is added to raw material as it moves downstream to satisfy demand and create value at the end of the chain.

In this regard, we may refer to the.... (Specific raw material) value chain or the value chain of... (For example, the *gold ore (raw material)*, the *rubber (raw material)* value chain, the *cotton (raw material)* value chain, and the *corn (raw material)* value chain. Each of these value chains will lead us to an end-product and identified final consumer(s) of such a product. The *gold ore* value chain

for instance (Figure 5.8) leads to gold as end-product which is then used as a raw material for gold jewellery and other consumable products and services as we move down stream. This means that the value chain of one product feeds forward into other value chains, resulting in a complex network of value chains.

In relation to rubber, for example, the farmer as a supplier (located upstream in Figure 5.4) can think in terms of the *rubber value chain*, tracing it downstream to an end product such as a *tyre*. We note then that a tyre as an end product of the plantation farmer's resource can become an input (which is one of the critical items consumed by the gold mining industry). The mining industry can in turn trace the tyre backwards to the supplier in the upstream link (i.e. the plantation farmer). Consequently, the mining industry as an end-user of the tyre can think of it as the tyre supply chain.

As a further illustration, we may consider that whilst corn may seem unrelated to the mining industry, it is possible to trace corn to a final product such as *bread*. It must be noted that bread is a *staple* food for workers of the gold mining industry by catering service providers. This means value is added to the corn to become bread, consumed by the mining industry at the end of the value chain.

Thus, in terms of the concept of the supply chain, the term can more appropriately be used when thinking about finished products. In the context of this study, a finished product is made up of *raw material(s)* transformed by activities deemed to add value to raw material(s). This means that a supply chain starts (triggered by) the final consumer and ends when goods and services are delivered to satisfy the consumer's demand. Thus in Figure 5.4, the supply chain necessarily encompasses both the forward and backward flow of activities that constitute the framework. The process of adding value to raw materials to satisfy demand gives rise to different types of inventories in the supply chain, resulting in a need to manage different types of inventories/stock in the system, particularly, at the firm level, including raw material, pipeline, cyclic and safety stock. It also involves the need to manage warehousing and storage space and the management of distribution networks and transportation to and from consumers. Thinking about the supply chain for specific items, such as tyres, can bring more clarity about activities and processes and help to make sound strategic, operational, and tactical decisions about them. For example, thinking in terms of a tyre supply chain, like any other product used by the industry, allows us to analyse and strategically address issues that are associated with the sourcing/ production of tyres and make sound decisions about the logistics of distribution, goods return (reverse logistics) and repair, transportation, warehousing, and inventories until the end consumer is reached.

This makes the concept of supply chain to be broad and its management quite complex. The following definition of supply chain management by the Council of Supply Chain Management may help to illustrate the concept further.

*Supply chain management encompasses the **planning and management of all activities involved in sourcing and procurement, conversion, and all logistics management***

*activities. Importantly, it also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third party service providers and customers. In essence, **supply chain management** integrates **supply** and **demand management within and across companies...** (CSCMP, 2013, p. 188)*

Notice the key words in bold letters – that is the nature of complexity that is entailed in the notion of a supply chain. Hence, a supply chain approach necessarily requires us to integrate the system from end-to-end (Schrageheim et al., 2009). In the case of the gold mining industry in Ghana, integrating the system from a supply chain perspective would therefore require a conscious effort (by government or mining companies as producers) to build market infrastructure for gold products, strengthen the sources of raw materials, and enhance visibility throughout the chain.

The starting point could be to identify opportunities in upstream (backwards linkages) that could be strengthened to support the industry whilst fulfilling the wider developmental goal(s) of the government. The tyre supply chain for example led to identification of original sources of the key raw materials used for tyre making, including cotton farms and rubber farms (Figure 5.6). Strengthening the cotton and rubber plantations could over time, contribute to the restoration of for example, the Firestone tyre company in Ghana. It could be recalled that the collapse of the Firestone tyre along with the Tarkwa gold refinery constitute some of the main concerns revealed from the field study (see section 4.4.1.4). Beyond the mining industry, other key economic sectors such as the garment industry could significantly benefit from the strengthening of cotton farming – the main raw material for the garment sector in Ghana.

Similarly, mapping the gold supply chain can be considered as leading to the identification of additional aspects and specific issues, including such details as the *Galamsey operators*, and *formal ASSGM operators* and *licensed gold buyers*, and how the activities of such actors are contributing to leakages of value (Figure 5.7). Such issues did not become so obvious through mapping of the gold value chain (Figure 5.5).

The above findings from a supply chain analysis have two main implications. First, it suggests that the gold mining industry in Ghana can maximise value/benefits for key stakeholders by developing and integrating for example, sources of raw materials in the upstream, value-adding activities (made up of LSGM and ASSGM activities) and the downstream activities (comprising intermediary services and the demand/consumption) consistent with Figure 5.4.

Secondly, it shows that there are numerous opportunities for backwards linkages as Bloch and Owusu (2012) noted. It is hoped that the tyre supply chain map and the notion of the supply chain used in this study (which has been simplified in accordance with Bloch & Owusu), would inform better understanding and sound policy decision making about strengthening of supply chains in Ghana.

However, the researcher suggests that it may be more practicable or feasible to identify specific items that are critical to the gold mining industry, to map the value chains/supply chain of each, to

identify and strengthen key links to support the industry in seeking to improve outcomes of the sector for key stakeholders.

We suggest that this situation demands a systems approach and would benefit from using the TOC 5FS process to identify and improve key links in the chain. Additional practical implications of the supply chain analysis of this study are considered as follows.

6.7.2 Practical implications of key findings from supply chain analysis frame

Findings from the supply chain analysis frame can be considered with respect to each of the activities involved in the supply chain analysis process. In this regard, three important activities are discussed, namely: mapping of the *gold ore* value chain in general, *quantitative analysis relating to internal operations* (see Table 5.9), and mapping of the tyre and gold supply chains.

6.7.2.1 ‘Quick-hit’ national approach to supplier development in Ghana

In order to establish and sustain competitive advantage, in terms described by Porter (1990), the researcher suggests that government and the gold mining industry could consider strengthening the capacity of domestic supply chains in Ghana.

As demonstrated, this would necessarily require mapping the supply chain of specific items used by the industry, (see Figures 5.9 & 5.10). This would help to identify weaknesses and opportunities that must be improved to strengthen Ghana’s capacity for mutually beneficial domestic investment. For example, it could be noted from the ‘tyre’ supply chain in Figure 5.9 that by focusing on the development of the *cotton sector* and *the rubber plantation sector* in Ghana, the capacity of local suppliers to supply raw materials to produce and supply *tyres* at more competitive prices will, over time, be strengthened.

Indeed, the researcher notes an implied awareness of, and an intent by the government and the industry, to develop domestic capacity in Ghana. However, the approach taken by Government must provide adequate focus, particularly on the sources of raw materials. Yet, it appears current effort by the government is focused on legislating for items that the industry must purchase locally in Ghana, thus, constituting a short-term approach from the perspective of this study. Table 6.1 below for example, shows a list of items compiled by the researcher which clearly shows that indeed, from 2014 to 2018, efforts to develop domestic capacity have been focused on ‘quick hit’ opportunities instead of providing sustainable solutions.

It is also noted that whilst the use of such national-level policies work for resource-endowed economies such as Canada and Australia, the approach has not helped in a developing-world context, including resource-endowed African countries (Fliess et al., 2017; Korinek & Ramdoo, 2017). In the specific case of Ghana, this is due largely to the lack of adequate organisational, logistical, technological and equipment infrastructure, particularly the lack of capacity of local suppliers to supply the gold mining industry without relying on foreign suppliers as a participant voice highlighted below suggests. In relation to tyres for example, Table 6.1 suggests that government seems mainly interested in the recycling (‘re-treading’) of tyres. Incidentally, re-

treading of tyres reflects *a reverse flow* and is therefore a commendable approach that may need to be encouraged from a supply chain perspective. However, without developing the cotton and rubber sectors in Ghana, the industry risks leaking *value-adding tyre manufacturing activities to be undertaken by overseas tyre manufacturers*. Note that leakage of value-adding activities to be undertaken/benefit overseas suppliers is one of the undesirable issues (UDEs) captured by the CRT (Figure 5.24) and a fundamental concern of stakeholders as reflecting in the below viewpoint (section 4.4.1.2) as illustrated below.

'In terms of statistics, about 90% of materials are bought from overseas and about 10% from local sources. We are not benefiting much from the sector, and the reason is that our local suppliers rely on overseas suppliers.'

'So the 10% we source from local suppliers ends up coming from overseas because we have not developed the capacity of our local supply chains to independently supply most inputs required by the gold industry locally [FL06]'

Table 6.1: List of items legislated for local procurement

Item	2014	2015	2018
1	Grinding Media	Bolt & Nuts	Security Services (Exclusive Ghanaian Directors & Shareholders)
2	Explosives (Emulsion)	Crucibles	Legal Services (Exclusive Ghanaians)
3	Cement & Cement Products/Grout	Plastic Sample Bags	Insurance Services (Strictly incorporated in Ghana)
4	Quick & Hydrated Lime	Calico Bags	Financial Services (Strictly incorporated in Ghana)
5	Electrical Cables	Bullion Boxes	Contract Mining (Strictly incorporated in Ghana)
6	High Density Polythene(HDPE) Polyvinyl Chloride (PVC) Pipes	Chain Link Fencing/ Wire Netting / Barbed Wire	Fuel (Exclusive Ghanaian Directors & Shareholders)
7	General Lubricants	Conveyor Rollers	Activated Carbon
8	Re-treading of Tyres	Metal/PVC Core Trays	Cable Bolt and Accessories, Split Setts
9		Overalls & Working Clothes	Wear Resistant Plates e.g. Hardox.
10		Haulage Services	Cupels
11		Catering Services	

Clearly, the *'quick hit'* approach taken by the government, with legislative measures, pressures gold mining companies to increase expenditure on local purchases in Ghana. However, according to the analysis of this study, forcing mining companies to go local without developing the capability of local companies to produce and supply independently from overseas sources, is a key challenge. It may contribute to a significant increase in the costs of the industry and reduces its ability to efficiently create value for stakeholders.

For example, from Table 5.9 (the quantitative data in Chapter 5), it could be seen that expenditure on local purchases on mining consumables in Ghana is increasingly growing from 2015 to 2019

compared to expenditure on consumables purchased from overseas suppliers. From USD 8.65m in 2015, for example, expenditure on local consumables rose to USD1.8bn in 2019. This is graphically shown in Figure 6.1 below, displaying that there is a wide gap between expenditure on consumables purchased locally and those from overseas, the latter constituting a smaller number of purchases compared to the former. This should necessarily translate to maximum benefit for local Ghanaian suppliers but does not. This is because local suppliers depend on overseas suppliers to supply the needed items, as explained above.

In addition to making the industry operationally inefficient, the current approach to developing local suppliers may also be contributing to the collapse of local industries such as the *Firestone Tyre Manufacturing Company* and the Tarkwa gold refinery which cases were described in section 4.4.1.4. Also, we see the effect of situations such as the above also reflecting on the CRT (Figure 5.24) where to maximise Ghana's benefits, Government decides to ring-fence/charge VAT on exploration activities (short-term focus), making it challenging for mining companies to realise their economic goals. As the challenges intensify, mining companies resort to cost-cutting measures to remain in business, thereby adversely affecting the employment potential and to thus, reinforce the need to maximise Ghana's benefits.

Figure 6.1: Expenditure on local versus imported consumables - 2015-2019

As with the *tyre* supply chain case discussed above, Figure 5.7 provides the vertical and horizontal depiction of players, activities, processes, and relationships that are involved from end-to-end in the gold supply chain. ‘Vertically’, there are actors such as exploration companies, producing companies, ostensibly-formal ASSM operators and the rudimentary, relatively informal, yet mechanised Galamsey operators that together contribute to value creation in the gold mining industry in Ghana. Adopting a TOC systems supply chain perspective (Schrageheim et al., 2009) promoted by this study, the activities of these industry players cannot be managed in isolation.

However, in practice, each of these players is focusing on their own activities. At the industry level for example, most exploration companies and producing companies are operated as isolated activities by different companies. Informal discussions with participants of this study indicated that most exploration companies (a.k.a junior mining companies or mining juniors), often transfer ownership of their concessions to other companies directly (call it FDI-FDI takeovers or transactions³⁷). As reflected in the feedback illustrated below, there is information asymmetry that advantages such FDI companies but disadvantages the Ghanaian government, particularly during the project negotiations processes. Hence, allowing FDI-FDI takeovers or transactions without requiring such companies to go through a competitive tendering process (despite the presence of such a stakeholder as the *Public Procurement Authority* – see Table 5.1) constitutes a key weakness of the negotiations and tendering processes. It allows significant value to be leaked out of Ghana through FDI-FDI transactions or takeover arrangements.

Also, at the national level, the risks in the sector's activities are not equitably shared, and neither are the benefits equally distributed, particularly between the government and multinational mining companies in Ghana (section 4.3.3.2).

This is illustrated in the viewpoint below.

Of course, companies can also win big if the project is successful. So, if we want to gain more as a country, then the government must be prepared to share the investment risks with the mining companies. Also, when investors express an interest to invest, we need to negotiate for a win-win.

We must ensure to calculate all the risks involved and share accordingly. The companies that invest in the industry are multinationals. They have access to [more] information about the industry than we have as a country which makes them more powerful than us. It is not only in gold mining but the extractive industry in general, which includes the oil and gas sectors. Ghana lacks people who are well-trained to negotiate for a win-win outcome for the country. [NL04]

Additionally, insights from the contextual literature on gold mining industry in Ghana (Aubynn, 2009) and field study (section 4.4.2.2) reflect an agreement between theory and practice that the is characterised by a gap between government priorities for LSGM and ASSGM sectors. Instead, it appears to be deliberately *siloed* to attract foreign direct investment into the LSGM sector whilst reserving the ASSGM sector for poverty-driven community mining activities.

The ramifications of this reductionist and fragmented approach are not limited to operational conflict between the two sub-sectors as reflected in the literature. It has largely contributed to the *illicit mechanisation* of the ASSGM sector (4.4.2.2) and facilitated the illicit flow of value. As indicated by the gold supply chain in Figure 5.7 for example, some (not insignificant) amount of gold appears to be leaking through the artisanal gold market to sponsors of Galamsey activities

³⁷ FDI-FDI Transactions or Takeovers is used in the context of this study to imply the transfer of ownership of a mining project from one foreign direct investment company who acquires the license to mine, directly to another foreign direct investment company.

(comprising Ghanaians and foreigners) and *cash customers* of the market. See also the reinforcing loop captured by the CRT (Figure 5.23) and the FDI Dependency loop (R1) in Figure 5.13 as a consequence of the current approach.

The silo mentality is not limited to the industry level. For example, at the firm level, most LSGM companies run two projects, each managed as a separate entity with disparate budget and targets and separate purchasing functions per the researcher's experience with the industry. As long as this silo mentality occurs at the firm level, the government of Ghana is also motivated to treat each business unit as a separate entity. This leads to the use by the government of fiscal policies such as ring-fencing that require such companies to meet tax obligations for each business unit (section 4.3.3.1) separately and making it impossible for companies to offset losses from one against profits on another.

Having considered key aspects relating to vertical relationships in the gold supply chain, management of relationships and processes in the horizontal chain of activities from ore sources to end-users (Figure 5.5) is discussed next. It must be noted that in Chapter 5, the aspect of the horizontal activities or processes was mapped separately and referred to as the *gold ore* value chain (Figure 5.5). Remember that mapping the value gold ore value chain was supported with quantitative data relating specifically to the LSGM sector (Table 5.9).

Hence, the discussion will draw from both Table 5.9 and Figure 5.5 as these provide more detailed analysis of the horizontal chain of activities than is captured in Figure 5.7 which offers a high-level map.

6.7.2.3 There is no one managing the gold ore value chain in Ghana

In relation to the *gold ore* value chain, the analysis revealed a wide-range of value-adding activities from *gold ore* (upstream) to final consumers (downstream). Table 6.2 provides specific details of each of these value-adding activities and highlights key decision points associated with each. As the constitutionally-mandated owner of all gold resources on behalf of the citizens of Ghana, government can be considered the supplier of the *gold ore* although the surface rights³⁸ of the ore-bearing land belongs to the people.

Table 6.2: List of specific value-adding activities and key decision points in the horizontal chain

³⁸ Means anything on the surface of the land and beneath (i.e. all the mineral resources endowments of Ghana) belongs to the people the government respectively.

Ore Reserves in Ghana	(Exploration & Discovery)	Mine Planning & Development	Mine Operations/Project Management
<p>1. Resource management/ Governance:</p> <ul style="list-style-type: none"> -Decision Making about the Management and Utilisation of Mineral Revenues - Development of Legal framework/Fiscal Regime - Contract negotiation <p>2. Management of the Fiscal Regime</p> <p>Implementation/Administration of the Mining and Fiscal Regime</p> <p>3. Infrastructural Development:</p> <ul style="list-style-type: none"> - Institutional Infrastructure; - Human Capital Development <p>4. Managing Raw Materials</p> <ul style="list-style-type: none"> - Supply Design/Development of Supply Chain Infrastructure - Supply Chain Mapping - Development of Primary Industries(Backwards and Foreword Linkages) -Deciding which Industries to Attract Locally -Supplier Relationship Management/Supplier Development Supply Chain Performance 	<p>1. Decision making about Investment in Research and Development</p> <ul style="list-style-type: none"> - Greenfield Exploration versus Brownfield Projects - Sourcing (R&D) Strategy Capital Project Development versus Incremental Projects -Local Investment Capital versus Foreign Investment Capital <p>2. Contract Administration /Management:</p> <ul style="list-style-type: none"> - Contract negotiation Legal consents - Issuing/Securing prospecting and exploration license <p>3. Geological and Geophysical Mapping/Survey-</p> <ul style="list-style-type: none"> - Geophysical Analysis and identification of potential gold-bearing rock types - Geological Analysis of rock types(mineralisation) - Geochemical Analysis - Drilling and Blasting Activities 	<p>1. Life of Mine (LoM) planning:</p> <ul style="list-style-type: none"> - Assessment of risks and uncertainties - Economics of mining and capital budgeting considerations - Mining Method/Mine Closure Considerations: Mine method: Surface versus underground mining depending on closeness of ore body, determined through exploration -Closure Considerations: Ongoing analysis and management of impacts - Stakeholder analysis and engagement; regulatory compliance; CSR <p>2. Supply chain design considerations</p> <ul style="list-style-type: none"> - supply chain mapping -Supplier Relationship (VMI, MTO, MTA, MTS, Contracts <p>3. Engineering and construction:</p> <ul style="list-style-type: none"> - Site preparation and road network. - Installation of processing technologies and IT infrastructure - Provision of Energy and Water Infrastructure <p>4 Work force arrangements: Expat (foreign) versus local; FIFO (DIDO) versus residential workforce.</p>	<p>Operations/logistics/project /Process management:</p> <ul style="list-style-type: none"> - Clearing of vegetation - Pit construction - Ongoing drilling and blasting activities -Transportation/Stockpiling of Ore: Loading and hauling of ore from pit to storage (stockpiling) -Processing of Ore: Crushing & Grinding (Milling); Physical Concentration; Flotation; (Roasting), Leaching; Carbon Absorption/Elution -Deciding Recovery Rate: The higher the rate of recovery the more expensive; the lower the recovery rate the greater the amount of ore to be extracted and hence, the higher the cost of operations. - Procurement, Logistics and warehousing/stores management - Ongoing analysis and Management of Impacts (Tailings dump, waste rock, water treatment, noise control...) till end of life of mine (mine closure) -Mine Closure – Rehabilitation
Transport of Semi-Refined Gold to Port in Ghana.	Ports Handling in Ghana	Transport/Shipping of Semi-refined gold from Ghana.	Refining/Fabrication
<ul style="list-style-type: none"> - Onsite storage (gold room) with in-house security monitoring and guard services - Checks and balances (Gold Assay by Government agent) - Transport from site to port: (Air-lifting) or road freight with security escort (including military and police escort). Insurance from site to port of shipment. 	<p>Port handling and storage in transit (Ghana)</p> <ul style="list-style-type: none"> - Inspections, final assay, export documentation processing and approval for export; Insurance cover from Accra Ghana to Overseas destination 	<p>Transportation to overseas refinery house</p> <p>Customs clearance and handling at overseas destination</p>	<p>Assaying</p> <p>Bullion production:</p> <ul style="list-style-type: none"> -Gold Bars -Gold coins .
Billion Market & Financial Services	Manufacturing of Gold Products	Distribution of Consumer Products	End-user/consumption -
<p>Marketing Management</p> <p>Gold trading:</p> <p>Over the Counter Market (OTC)</p> <p>Gold Futures</p> <p>Gold Exchange Traded Funds</p> <p>Bullion Banking & Insurance</p> <p>Securities/Brokers</p>	<ul style="list-style-type: none"> - Gold Jewellery - Medical/Dental Devices - Technology products (Eg. Semi Conductors used in computers, mobile phones and electronic gadgets, and Space Crafts (Space Shuttles operated by NASA). 	<p>Logistics and Transportation</p> <p>Infrastructure</p> <p>Fleet Management</p> <p>Wholesale</p> <p>Retail</p> <p>Demand/Order Management:</p> <p>Pull versus Push System</p>	<p>Order Fulfillment</p> <ul style="list-style-type: none"> - After Sales Services - Customer Relationship Management <p>Reverse Logistics:</p> <ul style="list-style-type: none"> -Recycling of scraps

Hence, in relation to the ore reserves dimension, the Government is duty-bound to add value to the citizens of Ghana, particularly the people of mining communities whose daily-life activities may be directly affected by the sector's activities. It must ensure it makes good decisions concerning the effective development of mining infrastructure and capturing value through an effective fiscal regime and promoting sustainable management and utilisation of the minerals revenues (Clark & Monk, 2010; Dixon & Monk, 2011; Dobbs et al., 2013). In addition, government must also make sound decisions to sustain raw materials as highlighted in Table 6.2, including deciding which industries it must attract, encourage, and support. By implication, the citizens of Ghana can be viewed as customers at the end of the value chain. A value chain approach necessarily requires activities of the industry to be managed in a coordinated manner across the gold ore value chain from upstream to downstream to ultimately protect and maximise value for the Ghanaian stakeholders of the industry.

However, the researcher notes that currently there is no one managing the *gold ore* value chain in Ghana. For example, Government mainly focuses on the revenues that it gains through gold exports. Similarly, mining companies are mainly focusing on their internal operations. As an aspect that reflects an opportunity to contribute to economic development of mining communities in relation to the mine planning and development phase in Table 6.2, mining companies are faced with the need to make sound decisions about work force arrangements. As the viewpoint below illustrates, companies have encouraged the use of 'drive-in-drive-out' (DIDO) workers but neglected the opportunity to contribute to the socio-economic development of mining communities through a residential workforce alternative.

Indeed, their expectations are quite difficult to measure because maybe today they want a 'good' school; tomorrow they want a 'good' hospital; the other day they wanted jobs.

On the other hand, it is hard to understand why we still transport people to work daily. It does not even make economic sense.

They should come to stay here. And if they come to stay, the communities around will see a facelift [FL04]

Additionally, regarding other aspects such as the bullion market as a typical value adding activity (Table 6.2 above), information available on the website of the World Gold Council implies that global demand for gold often exceeds its supply, and the excess is filled by recycling (see <https://www.gold.org/>). Thus technically, the gold market does not constitute a constraint since any amount of gold produced can be sold at any time. This confirms an emphatic viewpoint by Bolton (2018) that “the market is unconstrained” when it comes to the business of mining. Bolton's experience in the application of TOC-based management systems cut across several business sectors, including the mining industry, making his claim quite critical and noteworthy. Yet, gold mining companies in Ghana seems to be more concerned about the gold market (particularly, the price of gold) as constituting the core problem facing successful performance as reflected in the participant viewpoint that follows:

...The logic of redundancy is to survive when we cannot make it and when we have extra hands doing no job.

It means that if the business is booming, we may need extra hands and if the business is struggling as a result of a fall in gold prices and we cannot make it and all that we have got is to reduce factors of production then we have to do it for survival...[FL03]

Such misconception about the gold market conceals the sector's ability to see the core problem(s) constraining its performance and gives it limited control over the market, forcing companies to, in addition to laying off-staff, enter hedging arrangements that force them to sell semi-refined gold at prevailing prices/hedged prices. For example, some LSGM companies in Ghana such as Golden Star Resources (GSR) Limited, established hedging relationships through global market intermediaries such as the Macquarie Bank, seeking to protect against price fluctuations in the gold market (GSR, 2020) in the absence of local alternatives in Ghana. Notwithstanding this hedging arrangement, GSR ended up having to sell the project to another company as its situation worsened.

Thus besides constituting another means through which a significant amount of value leaks out of the economy of Ghana, some of these hedging relationships have in the past contributed to worsening, instead of strengthening, the financial situation of companies promoting the approach. Such cases where a leading gold mining company in Ghana has worsened its financial situation through hedging have prompted researchers such as Callahan (2002) to ask the question of whether or not such hedging contracts should be encouraged. This question reflects a typical example of the dilemmas and conflicts that must be addressed by the gold mining industry if it seeks to improve its ability to improve the sector's outcomes for key stakeholders. The concept of dilemma and conflicts are discussed further under section 6.9.

The absence of an effective value chain approach allowing leakages of value-adding activities to overseas companies; the perceived lack of control over the gold market; and the absence of local alternatives of services, including financial infrastructure provided by global intermediaries, seems to constitute major challenge that the industry needs to deal with.

In order to better understand how the absence of a value chain approach is shaping the nature of value creation and relationships amongst Ghanaian stakeholders of the gold mining industry in Ghana, we return to the quantitative analysis from Chapter 5 (Table 5.9). Perspectives from the field study are used to complement this analysis.

6.7.2.4 Siloes of value creation amongst key industry players

Drawing from Table 5.9, we note that are 12 mining companies in the LSGM sector produced and exported an aggregate of 13.7m oz of gold in 2015 to 2019. Of this, the top three (3) producers and exporters produced and exported 7.1m oz representing 51.9% of total exports, whilst the rest produced and exported a total of 6.6m oz (48.1 %) during the same period. This begs the question of whether government should maintain or reduce the number of companies participating in the LSGM sector in seeking to improve outcomes for stakeholders of the industry. Also, consistent

with a viewpoint captured under section 4.2.3.2 and further illustrated below, some of these mining companies seem to struggle for survival. *Company L* has for example, produced a total of just 58.5m oz of gold from 2015 to 2019. Similarly, others such as *Company J* and *Company K* also seem to be struggling with performance.

Even at *Company A*, which can be considered the leading producer and exporter of gold from 2015 to 2018, it could be noted that performance has been declining year on year. For example, production and export volumes declined steadily from 58.6 oz of gold in 2015, to 51.9 oz in 2019.

The above issues are consistent with the lack of a value chain approach. This leads to silos of fragmented value creation, each company within the sector functionally approaching value creation in isolation from the other players.

We have some mining companies that have not made a profit over several years, and they are still operating with the hope that they will be able to make that turn [around].

There are companies too that usually do not declare a profit, and they make a profit alright, but they do not declare [it or pay] dividends because they instead want to plough back the profit into their business.

Ploughing back the profit saves them from borrowing from the financial market and the cost associated with it. So, it makes sense for the company to retain portions of its profits or all of its profits, inject it into the business and then when it has achieved its objectives, it can start paying out profit [NL05]

As reflected in the above comment, the silo mentality of value creation has also been noted to lead to dishonest corporate practices, such as failing to declare profit. Such behaviours may promote the illicit flow of value (Pieth, 2018). It is therefore not surprising that the government of Ghana has responded to such issues aggressively, using fiscal policies such as ring-fencing, seeking to protect Ghana's interest or maximise its benefits.

Figure 6.2: Outputs of top 3 producers compared to other producers in the LSGM sector

6.7.2.5 Gold exported versus gold consumed in Ghana

From another perspective, one of the viewpoints surfaced at the national level suggests that at most 3kg of gold was consumed monthly by a leading Jewellery making company in Ghana. Moreover, that gold was sourced from the ASSGM sector (section 4.4.1.2).

Using a conversion rate of 1kg as equivalent to 32.15 oz, an estimated 3kg monthly consumption would be equivalent to about 1,157 oz per year. Using this estimate as the base amount of gold that was consumed locally in Ghana in the 2018 production year (Table 5.9), an estimate of gold produced versus exported is shown in Table 6.3 below.

It shows that the amount of the Ghana's gold ore that reached consumers at the end of the gold value chain in Ghana was about 0.02%, a seemingly insignificant amount. This suggests that as much as 99.98% of Ghana's gold ore reached overseas consumers during the study period in 2018.

It is interesting to note that, of the total amount of gold exported in 2018, government (represented by the PMMC) as the exporter of gold on behalf of the ASSGM sector, was the leading exporter. It exported over 1.9m oz of gold which is more than three times (3x) higher than the value of gold exported by the leading exporter of gold in the LSGM sector - Company A at only 524,869 oz. It is also higher than total gold exported by the top 5 gold exporters of the LSGM sector which amounted to a little over 1.8m oz in 2018. This is another leakage of value as a result of the lack of a value chain approach in Ghana. Government is the main contributor of such leakages according to this data.

Table 6.3: An estimate of gold produced versus exported in 2018

Year	2018 production versus export		
	LSGM sector	ASSGM sector	Combined
Gold produced by sector (oz)	2,804,990	1,985,600	<u>4,790,590</u>
	58.55%	41.45%	
Estimated amount of gold consumed locally in Ghana by sector (oz)	-	1,157.40	1,157.40
% of Gold consumed in Ghana	0.0%	0.06%	0.02%
Gold exported by the sector (oz)	2,804,990	1,984,442.60	4,789,432.60
% of gold exported by sector (oz)	100%	99.94%	99.98%

6.7.3 The role (contribution) of the government

In terms of the Ghanaian contribution to the gold mining industry value chain, the supply chain/value chain analyses suggest that Government's role is mainly limited to the development of the legal and physical infrastructure for mine operations, reflecting a reliance on the fiscal contribution that Ghana could gain from the sector. Indeed, other efforts to contribute to the sector's supply chain are based on legislation for local content procurement as listed in Table 6.1.

Indeed, having a long list of items to be procured locally is necessary but may not be sufficient to effectively capture benefits from the industry in a sustained manner. Based on the analysis provided here, a more effective solution would be to maximise benefit by seeking to increase the number of tiers of local suppliers of the mining procurement list.

We have already demonstrated the possibility of *increasing the number of tiers of suppliers* through mapping the supply chain of every single item to their sources of raw materials which may be a starting point for achieving the goal. This is consistent with Porter (1990) recommendation regarding the need to overcome local disadvantages. By mapping the supply chains and strengthening the sources of raw materials, we would in due course overcome local disadvantages linked to the gold supply/value chain.

Also, by successfully targeting and strengthening the sources of raw materials for maximising and sustaining benefit from the gold mining industry, we would be achieving a well-integrated economic development in Ghana. Consequently the call by stakeholders such as the *Minerals Commission of Ghana* (2015) to manage the industry to ensure development of direct and indirect mining linkages would be addressed.

The supply chain perspective taken by this study suggested that Government needs to *strengthen local consumption for gold* on the one hand, and *increase the number of tiers of local suppliers*

6.7.4 The nature of complexity captured by supply chain analysis

The gold mining supply/value chain diagrams of this study might look parsimonious or quite simply, partly because effort was made to ensure inherent simplicity rather than overcomplicating, so as to convey better understanding to policy decision makers of the industry. However, complexity is apparent in the international dimensions (i.e. differences in the nature of activities in the supply chain), and in the way the Ghanaian gold mining sector contributes to the network of (global) supply chains.

In terms of entities participating in the supply chain and the nature of activities, the analysis revealed a wide range comprising physical operations involved in mining extraction in Ghana through to, for example, the London Bullion Market with its electronic transfers, regulation/certification of actors and abstract pricing mechanisms – reflecting the nature of the industry.

The analysis also helped to reveal the complexity of the global nature of supply chain activities involved, encompassing interrelated Ghanaian parts; the dynamic nature of the supply chain – the unfolding of supply chain activities over time; and also feedback activities through reverse flow.

We now leave the application of SCA to consider key insights from the application of ST using CLD modelling, wherein dynamic effects and feedback are at the forefront of analysis.

6.8 Systems Thinking (ST) using the CLM and CLD Frames

In this section, we summarise selected findings and insights about our system of interest, the export potential of the gold mining sector, derived from CLM and the associated set of derived CLDs. We also comment on the use of CLM and CLDs.

As stated in 5.4.2, the CLDs, individually, and as a set, are meant to be indicative and illustrative rather than definitive and comprehensive in relation to the situational context of the export potential of the gold mining sector. The CLDs illustrate the representation of cause-effect relationships, the non-linear and dynamic nature of causal feedback loops that play out over time and do so within a wider systemic structure and wider system.

6.8.1 System Boundaries – Boundaries of interest, bounding the analysis

We draw attention to the importance of recognising the wider system, and whether the systems boundaries are acknowledged at different stages in CLM and in developing a comprehensive CLD. Here for example, both CLDs 1 and 2 are first presented as closed systems. This can bring focus to the initial variables of interest - *Government's need for investment funds for capital projects* in CLD 1 and *the relative benefit of FDI contractual terms for investment in gold mining...* in CLD2. It also introduces initial practical limits to the contextual scale in attempting to cope with the inherent complexity of the wider situation, and for practical purposes, it effectively treats causal relationships, causal feedback loops within CLDs 1 and 2 as being endogenous influencers of systems behaviour.

As such, caution must be exercised with respect to interpretation of CLDs 1 and 2 in the wider context and how the presentations may induce or seduce unintended systems myopia.

By contrast, the more extensive CLD 4 acknowledges explicitly where systems boundaries have been drawn by displaying exogenous variables as potential influences on that system. In CLD 4, these include the notions of *favourable exchange rates*, *political stability*, and *beneficial legal and fiscal environment* that impact the *attractiveness of investment* in the gold mining sector. *Government preferences relating to domestic economic development* and the building of *foreign exchange reserves* are also treated as exogenous variables.

6.8.2 Understanding systemic structure and systems boundaries

Our analysis noted that where individual sub-system structures CLDs 1 and 2 (Figures 10 & 11) have variables in common, they could be combined or linked to form the more expansive systemic structures CLDs 3 and 4 (Figures 12 & 13). We also note that linkages may vary in complexity, and that in this case, we note specifically that CLD 2 is embedded within CLD 1, rather than connected as a simpler chain link.

Although demonstration of this process (from CLDs 1 & 2 to CLDs 3 & 4) serves to illustrate the complexity of a widening context's systemic structure in terms of the increased number of variables, their relationships and their growing interconnectedness, the CLDs 3 and 4 point towards

and signal what may need to be an even more expansive representation of the wider gold mining system and its complexity through extending the system of interest's boundary.

It must be noted that whilst CLDs 1 and 2 have been presented initially as closed endogenous systems, by contrast, CLDs 3 and 4 signal the extent of interconnectedness of their systemic structures, thus disavowing any prior assumption that CLDs 1 and 2 are closed systems. As such, we reinforce the need for awareness of systems boundaries that may otherwise remain implicit in CLM and the development of CLDs.

6.8.3 Surfacing systems behaviour, systemic structure and systems archetypes

Despite these caveats and cautions, insights of note have emerged from analysis of the CLDs that share some communality in terms of systems effects and behaviour.

6.8.3.1 The shifting the burden archetype and conflict of choice

For instance, CLD 1 (Figure 5.10) surfaced a conflict of actions/choices in the sense that a quick fix action that works in the shorter-term – securing, and then relying on *FDI funds for the development of export potential of gold* may well undermine or nullify a more fundamental longer-term solution. CLD 1 conveys that as a result of the *growing dependency on FDI funds ...*, the *ability of government to focus on domestic economic development* weakens - thus, undermining an alternative Government option of *building capacity for domestic investment in Ghana* to satisfy the *Government's need for investment funds ...*

In summary, the quick fix short-term option may have undermined a more fundamental option of building Ghana's capability and capacity for meeting its financial and investment needs from within Ghana. The systemic nature of this conflict mirrors the systemic structure of the *Shifting the Burden* (StB) systems archetype (Senge, 1990).

A specific example, not made explicit in the CLDs, would be the establishment of the *Minerals Income Investment Fund* (MIIF) which seeks to raise about USD 500m as capital to fund investment projects in Ghana. In return for the funds, government has been prepared to trade-off or subordinate the future actions and revenue streams for Ghana by ceding or sacrificing to the funders 'all royalties for gold yet to be discovered' – in order that it can attend to present developmental needs. The situation is characteristic of the StB archetype and is captured in the CLD outlined in Figure 5.13.

6.8.3.2 The escalation of commitment archetype and party conflict over resource access

CLD 2 (Figure 5.11), on the other hand surfaced a conflict of interest between different parties over access to a share of a perceived common access resource that mirrors the *Escalation of Commitment* (EoC) systems archetype. Here, EoC can be considered in terms of how Government and FDI investors respond to perceptions of *relative benefit to investors of FDI contractual terms for investment in gold mining*.

A perception that the *relative benefit* may rest disproportionately with FDI investors may bolster *Government intent to change FDI contractual terms* (Ayisi, 2015; Eshun, 2018) to address its own interest. This action has the effect of decreasing such *relative benefit* and be interpreted by such companies as a *threat of government reneging on FDI contractual terms for investment*, thus provoking a response of *strengthening of FDI investors' intent to maintain the contractual terms*.

The *escalation* phenomenon can also be recognised in other behaviours observed in the study but not captured by the CLD . For example, government has chosen to ring-fence projects, to address a perceived *threat of fraudulent/tax avoidance* behaviours amongst some mining companies in Ghana. In turn, mining companies consider such actions by the government as a threat to their viability and their economic goals.

It is therefore not surprising that, to survive, mining companies tend to frequently cut back on labour costs, a counter-response that has cost the job of many Ghanaians successfully employed by the sector and increased unemployment in Ghana, adversely impacting Government resources and expenditure. The effective breakdown in relationship between Government and the mining sector feeds this escalation. As such, and then drawing on the stakeholder analysis, we may suggest that by developing the stakeholder management capability of all parties, relationships could be effectively managed to boost trust and cooperation in an attempt to overcome the systemic escalatory behaviour.

6.8.3.3 The apparent conflict of either/or choice

A similar insight emerges from the CLD 4 and analysis (Figure 5.13) that relates to the nature of government focus on *foreign exchange earnings*. For whilst maintaining a focus on *foreign exchange earnings* can create benefit as stated above, not maintaining such a focus may avoid the risk of being caught in the FDI dependency loop R1. The dilemma faced by the government is that it appears to be in conflict about not being able to both maintain and not maintain focus at the same time.

By contrast, the conflict implicit in the relative distribution of *investment capital* to benefit the entire *domestic supply chain* or to benefit individual organisations within the *domestic supply sector*, is not an either/or conflict and would be amenable to an approach that seeks a win-win solution. While investment in the domestic supply sector can be considered to bring short-term benefits, approach with *investment in domestic supply chains* is needed which has the potential for a more enhanced and sustained benefits.

However, the Government has committed to activities such as legislating for more supply items to be procured locally (see Table 6.1), as the main focus of its *National Supplier Development Program* (NSDP). Indeed, whilst this approach is in line with the *African Mining Vision* (AMV) (African Union, 2009), it seems to be driven by a short-term focus. The NSDP mainly emphasises development of individual suppliers to exploit benefits from higher levels of local expenditure by multinational mining companies (Ghana News Agency, 2017). Though this detail is not captured in the CLD analysis, this study notes that government has paid little or no attention to activities

such as investing in the strengthening of supply chains as a whole, for key items consumed by the goldmining industry. Such an alternative may have significant potential for generating sustained benefits for Ghanaian stakeholders of the gold industry.

6.8.3.4 Conflict arising from exogenous sources

Whilst the above conflicts appear endogenous to the systemic structures examined in CLDs 1, 2 and 3, CLD 4 also introduces a potential conflict reflective of *Government preferences* as exogenous variables – to use *foreign exchange earnings* for more immediate *domestic development* versus its *accumulation of foreign exchange reserves* for future rainy-day-use. Whilst we suggest that nature and differential strength of preferences would impact the *allocation of foreign exchange funds* to domestic economic development, this potential conflict is captured but not explored further in the CLD analysis.

6.8.4 Is there a silver bullet?

As stated in section 5.4.2, the complexity reflected by the CLD not only relates to scale and scope, that is boundary setting, the number of variables, relationships, non-linear causal loops, their inter-connectedness and embeddedness, but also preconceptions and preferences. It may be presumptuous to think that any single action, a silver bullet, whether a quick-fix or not, will only affect its target, resolve the conflict, produce the desired outcome, and address the appropriate goal.

Indeed, the CLD's presented here highlight a number of unintended consequences: side-effects that create other problems or undermine or nullify other potential solutions (as in CLD 1). They also surface dilemmas and conflicts that result from individual actions or systemic structure (as in CLD 2 & 4).

The researcher noted that whilst the CLM approach does not provide a means of resolving such dilemmas or conflicts, other systems approaches may do so. Additionally, the researcher had suggested that much could be gained from using TOC methods and tools to systematically seek out core problems, set higher level objectives for the system, and provide a means of charting how appropriate action can be implemented to reach one's goals and resolve conflict in a manner that seeks win-win outcomes, rather than treat the conflict as a zero-sum game. TOC analysis was undertaken in sections 5.5-5.7 and is discussed further in the next section.

6.9 The TOC Analysis Frame

As indicated in Chapter 3, this study began with the application of a provisional CRT (Appendix 1) to be used as a skeleton for data collection. Three (3) individual EC along with a generic EC (Figure 5.17) were developed, and a final CRT (Appendix 1) was then developed from the generic EC and a focused CRT (fCRT) applied to present key aspects in Chapter 5. Following the fCRT the final CRT was further broken down into three (3) sub-sets (Figure 5.23, 5.24 and 5.25) to illustrate important feedback loops as a further effort to providing stakeholders with a platform for better understanding about the industry. Subsequently, the GT (Figure 5.26) was also applied

whilst reserving the FRT and the PRT tools for consideration in this Chapter. Hence, it is important to discuss key aspects about CRT, EC, then GT, before considering the FRT and PRT. As indicated before, the numbering used in the entities/boxes of the TOC diagrams are just to keep track of the boxes and help with location and narration as will be illustrated in the CRT – they are not significant otherwise.

6.9.1 The CRT approach

In Chapter 5, the focus was developing the final CRT from the Generic EC and demonstrating the application of the fCRT. In this section, attention turns to the overall UDE, the key entities in the provisional CRT that were corrected following the field study, and the key variables that were added, and how this improved the researcher's understanding of the complex cause-effect relationships limiting desirable outcomes for stakeholders of the industry. A complete list of factors captured by the final CRT is provided in Table 6.4.

6.9.1.1 Correcting assumptions contributing to the overall UDE

As shown in the provisional CRT (Appendix 1), the overall UDE is entity 140. *Benefits for stakeholders (State, communities & investors) fall short of expectations*. Indeed, this entity was confirmed by participants during the field study as illustrated in Table 3.2. However, the final CRT differs from the provisional CRT in terms of the complexity and other characteristics of the intermediate cause-effect relationships that contribute to the overall UDE, in several ways.

Firstly, the final CRT is more complicated than the provisional CRT as measured by the number of entities (Table 6.4). They also differ in terms of logical coherence. This can be illustrated by looking at the cause-effect relationships leading directly into the overall UDE and Ghana's economic potential of gold mining as follows.

In the provisional CRT, there are five main entities leading into the overall UDE. However, only two of these, including 130. *Economic potential of Ghana's gold mining industry is not realised*; and 120. *Employees of LSGM sector are faced with repeated episodes of redundancy*, were confirmed by the study's participants. Other entities, namely: 115. *Shareholder expectations are not met relative to expectations*; 110. *Social benefit of gold mining is less than desired*; and 102. *Ghana's environmental cost of gold mining is high* were not confirmed.

In terms of entity 115 for example, participants generally expressed a view that can be captured as "I am not a shareholder. So, I wouldn't be able to establish whether they achieve their expectation or not."

Entity 110 was highly contested by participants at the firm level who often referred particularly to the sector's commitment to CSR, and vague expectations of mining communities (as captured in section 4.2.2.3) to justify their position.

Also, as illustrated in section 4.2.2.4, the viewpoint of an industry expert emphasised the positive impact of gold mining in Ghana and listed examples of key infrastructural projects. These include

the sector's contribution through the construction of roads, and other projects that were ongoing at the time of this study - building of a police station and a nursing school by some mining companies.

Indeed, despite concerns raised about aspects such as livelihood and infrastructural issues by participants at the community level, the main concern seemed to be centred on the lack of a formal document or agreement such as an MOU to govern their relationship with mining companies. As a result, members of mining communities often embark on demonstrations in order to get the government to act on their behalf.

Taking the above issues into account, the researcher considered that entity 110. *Social benefit of gold mining is less than desired* is also not confirmed, and hence is not included in the final CRT.

With reference to entity 102. *Ghana's environmental cost of gold mining is high*, the researcher realised during the discussion sessions that participants asked about the meaning of 'environmental cost'. Although the entity was not directly contested by participants, the researcher drew on the concept of clarity in the categories of legitimate reservations (CLRs) to conclude that entity 102 lacked clarity and needed to be refined. Accordingly, this entity was refined as 'remediation cost' based on insights from a range of viewpoints outlined under section 4.4.2. It suggests that government expenditure on remediation increases as an unintended consequence of decisions taken about the ASSGM sector.

Indeed, participants also contested entity 29. *Managers lose focus*, arguing for example that whilst their attention often wanders, they don't consider it to constitute losing focus. After all, whatever may distract them from their core duties as managers is considered by them to be of a higher risk according to the participants. However, the researcher drew insight from Goldratt (Goldratt Consulting, 2017) whose views about management attention can be paraphrased as follows:

The core duty of managers is to manage the system in the face of complexity, uncertainty and conflict. In almost any organisation (including those in the mining industry in Ghana), there are plenty of things that require management attention. Hence, management attention may be diverted from focusing on system goals and instead chasing local optima which are not in line with global objectives.

Considering the above viewpoint, the researcher resolved that the only way managers' attention could be distracted is when they have lost focus on the core duties, suggesting that managers getting distracted is an additional entity from entity 29. Entity 29 was therefore maintained whilst amending entity 44. *Management attention is often wasted* with "*Management attention is often distracted.*"

6.9.1.2 Capturing additional entities leading to the overall UDE

In addition to capturing complexity in detail and improving the logical coherence, the final CRT also captured a range of factors that may help to offer a better explanation of the cause-effect relationships that contribute to the overall UDE. This can be illustrated by drawing from Appendix 1 which constitutes the complete CRT of this study. This includes the intermediate effect - entity 210. *Maximising benefits for stakeholders is absolutely impossible.*

The researcher noted that despite attempts made to explain issues limiting desirable outcomes for stakeholders of the industry, prior literature seems to overlook important variables such as entity 210 in the final CRT (Appendix 1) and a range of other variables that contribute to its existence, such as: 201. *Stakeholder's value creation is not the main focus of the gold mining industry in Ghana*; 171. *Key stakeholders (including mining communities) cannot guarantee their commitment and support*; 160. *There is no common goal to direct the priorities of key stakeholders*; and 100. *The ERSBA framework allows for LSGM activities in forest reserves with known economic prospect for ore deposit.*

Underlying the above factors are other key 'intermediate effects'³⁹ (ImE – singular) or (ImEs - plural), such as 23. *Actions taken to ensure positive (address adverse) impacts result in paradoxes*, and 11. *Each stakeholder prioritises their own interest*. These issues are amongst the main ImEs that contribute to the overall UDE. These ImEs were missing from the provisional CRT which was largely limited to issues highlighted by previous literature.

By providing a voice to stakeholders to share their views about issues captured by the provisional CRT and subjecting such viewpoints to further analysis through the multi-framing approach, the researcher gained insights that helped to identify these additional factors.

Specifically, it helped to identify the underlying issue that contributes to the overall UDE. To illustrate, Appendix 1 revealed entity 05. *There is no collective effort/industry is characterised by win-lose relationships among stakeholders* as the core problem/root cause which is leading to the overall UDE. It could be observed that these factors are 'tautologically' the same – one is definition of the other (chicken and egg, can't tell which one causes the other).

Indeed, other factors that contribute to the overall UDE as captured in Table 6.4 are entity 191. *Ghana fails to realise potential benefits from ASSGM sector*, which gives rise to entity 205. *Ghana's economic potential of gold mining is not fulfilled.*

Also noteworthy as additional factors included in Table 6.4 are some that contribute to entity 215 highlighted above which this study considers as new additions to what is already known. Key amongst these factors include: entity 155. *Remediation cost/risks through ASSGM supply chain increases*, which can be considered as an unintended consequence

³⁹ Intermediate effects are factors (entities) that are causes as well as effects

It would seem that many of these entities have emerged from the SCA and CLD analyses as covered in the previous sections. These include entities such as 142. *Gold leaks through the supply/value chain of ASSGM sector*; 144. *Leakages of profit to foreigners occurs*; 135. *Dealers sell gold to foreign buyers directly*; 74. *Licensed gold dealers in Ghana support Galamsey*; 55; and *Government licenses local gold dealers to buy gold from the ASSGM (including Galamsey) sector*.

Underlying most of the issues relating to the ASSGM is: 15. *Government encourages FDI firms to address lack of funds for investment/boost foreign exchange earnings*. Hence this and other underlying factors contributing to the UDE have been analysed further using the FRT tool

Following insights from the field study and the development of the final CRT from the generic EC, the researcher's understanding about the issues limiting desirable outcomes for the gold mining industry in Ghana evolved. Particularly, the results showed that the nature of cause-effect relationships in the provisional CRT developed mainly from assumptions highlighted by the literature, underestimated the complexity of the issue.

Table 6.4 provides a list of all entities in the final CRT (Appendix 9). The green, gold and pink colour codes represent *objective* (A), *requirements* B and C, and *prerequisites* D and D' from the generic EC (Figure 5.17) respectively while blue colour means precondition. Also, the entity coded red is the root cause of most of the issues that are currently contributing to the overall UDE (coded grey) in cell number 1 of Table 6.4 below.

Table 6.4: List of entities in the Final CRT (Appendix 9)

List of Entities captured in final CRT (Appendix 1)		List of entities captured in final CRT continues	
215. Benefits for Stakeholders (State, communities & investors) fall short of expectations.	132. Ring-fencing allows gov't to protect against tax avoidance.	205. Ghana's economic potential of gold mining sector is not fulfilled.	74. Licensed gold dealers in Ghana "support" Galamsey.
210. Maximising benefits for stakeholders is absolutely impossible.	131. Government is motivated to protect/maximise Ghana's revenues.	191. Ghana fails to realise potential benefits from ASSGM sector.	51. Licensed gold dealers have well-established relationship with Galamsey operators.
205. Ghana's economic potential of gold mining sector is not fulfilled.	130. It is believed that some companies fail to declare profits to avoid payment of taxes.	182. ASSGM sector is not supported and remains under developed.	55. Government licenses local gold dealers to buy gold from ASSGM (including, Galamsey) sector.
201. Stakeholder value creation is not the main focus of the gold mining industry in Ghana.	60. Government prioritises the ERSBA framework for governing agreement with developers of LSGM sector.	183. There are unpaid taxes through ASSGM sector.	41. Government reserves small-scale mining licenses for locals only.
171. Key stakeholders (including mining communities) cannot guarantee their commitment and support.	121. Management attention is often distracted.	173. Government feels pressured to ban most ASSGM activities.	42. Government does not provide ASSGM operators support.
190. Employees of LSGM sector are faced with repeated episodes of redundancy.	50. Regulators believe in the ERSBA Framework.	155. Remediation costs/risks through ASSGM supply chain increase.	43. No FDI goes to ASSGM sector.
160. There is no common goal to direct the priorities of key stakeholders.	111. Managers lose focus	142. Gold leaks through supply/value chain of ASSGM sector.	45. ASSGM operators need financial and technical support to be more productive
120. Vulnerable stakeholders including mining communities are adversely affected.	105. LSGM sector engages in silo thinking.	143. Environmental degradation and pollution associated with ASSGM gold mining in Ghana rises.	32. ASSGM is good source of income for locals.
181. Value-adding activities are undertaken/benefit overseas firms.	101. Managers have too many decisions to make in time available.	144. Leakages of profit to foreigners occurs.	35. Government prioritises development of LSGM sector in Ghana for FDI.
180. Mining companies struggle to achieve their economic goals.	30 (D). Government feels pressured to maintain tighter regulatory system.	135. Dealers sell gold to foreign buyers directly.	25 (D'). Government feels pressured to provide a facilitative regulatory system for FDI in mining.
110. The interest of other key stakeholders (including mining communities and future generations) are being compromised.	33. The ERSBA framework allows for tighter regulation to be built into the project approval process.	122. ASSGM mining activities involve use of unsafe production methods that endanger the environment.	27. FDI is attracted to LSGM sector in Ghana.
172. Operating cost of LSGM sector increases.	90. LSGM entities pursue functional objectives at firms/departmental levels.	125. Foreigners invest more (more) in LSGM techniques illegally and reap untaxed profits.	15. Government encourages FDI firms to address lack of funds for investment/boost foreign exchange earnings.
100. The ERSBA framework allows for LSGM activities in forest reserves with known economic prospect for ore deposits.	21 (B). Government needs to improve the impact (reduce negative impacts) of gold mining.	113. Dealers look for cash buyers.	12 (C). Government needs to provide a more (favourable) business environment.
164. Significant amount of semi-refined gold is exported to overseas refineries.	23. Actions taken to ensure positive (address adverse) impacts result in paradoxes.	114. Foreign buyers have cash.	133. Complexity in gold mining supply/value chain is not well-managed
163. Operational efficiency and effectiveness is not achieved.	82. LSGM sector wants to control operating cost/ work within operating budget.	112. Government only does bank transfers.	

Table 6.4 Continued

154. Local consumption of gold is not prioritised.	72. LSGM mining sector operates a cost-driven model.	115. ASSGM market is not concerned about environmental and social performance.
153. Gold mining supply/value chain is not harnessed.	61. The traditional logic of management emphasises functional objectives/ maximum internal control/ efficient utilisation to factors of production.	85. There are financial benefits for foreigners to invest in ASSGM sector.
150. Government uses aggressive fiscal policies (such as ring-fencing/ VAT on exploration).	63. Sector believes in traditional logic of management	83. Foreigners are allowed to invest in "mine support services" in ASSGM sector
151. Using aggressive policies such as ring-fencing and VAT on exploration increases operating costs/distorts investment decisions of LSGM companies.	11. Each stakeholder prioritises their own interest.	91. Dealers want fast profit.
81. The ERSBA framework provides a regulatory solution to adverse impacts of LSGM sector.	10. There are concerns about the impact of gold mining in Ghana.	92. Dealers need cash to pay workers.
80. LSGM sector expresses interest to mine in forest reserves with known economic prospect for ore deposits.	05. There is no collective effort/industry is characterised by win-lose relationship among stakeholders.	93. ASSGM market is not monitored/controlled for environmental and social performance.
140. Capability of local economic activities linked to gold mining supply/value chain is not developed/not harnessed.	03. The ability of mining companies to realise their economic objectives is enhanced by having a favourable (facilitative) business environment.	94. There is a local gold market for ASSGM sector.
71. LSGM sector has to comply and fulfil social and environmental obligations under the ERSBA framework.	02. The ability of gov't to realise more economic gains depends on the ability of mining companies to realise their economic goals.	75. There is untapped potential in ASSGM.
70. Reserves are limited/economic grades of known deposits are being depleted increasingly more.	01 (A). Government wants to achieve economic development and poverty reduction from gold mining now and in the future.	73. Support includes wages and operating equipment in return for gold mined (extracted & waste ore).

6.9.2 The Evaporating Cloud (EC)

In the context of this study, the EC was initially used to capture complexity and explore the various dilemmas and conflict situations that came to light. Table 6.2 provides a summarised list of these situations that were identified and framed using the EC tool. Most of the situations framed required stakeholders to make decisions between options that offered them short-term relief (solution) versus a long-term solution, to key questions, concerns and issues facing the industry. Results indicate that in all of the cases framed, trade-offs and compromises were being made, with decision makers often prioritising the short-term solution over the longer-term alternatives.

The systematic nature of such trade-offs and compromises made towards short-term solutions helped the researcher firstly, to be guided to recognise dilemmas and conflicts, and secondly, to demonstrate that such situations can be addressed without compromises. While dilemmas and

conflicts both require a win-win solution to be effectively addressed and benefit from the application of the EC, the distinction between the two perspectives is outlined next.

6.9.2.1 The concept of a dilemma

In this study, the term dilemma is used to refer to situations where the decision maker – in this case, government, mining company or mining community, was found to be at conflict internally when faced with the need to make a decision between competing options that directly impacted on their individual interests. In Chapter 5 for example, three specific situations were analysed that reflect a dilemma at the national, firm and community levels.

Government is in dilemma (conflict with itself) to be export-driven on the one hand and to be locally-driven on the other hand, in relation to maximising Ghana's benefit from gold mining, now and in the future (Figure 5.14). The LSGM sector is found to be in a similar situation regarding whether or not it should pursue functional objectives towards its business goals (Figure 5.15). At the community level, a key dilemma relates to whether members should prioritise their support for the ASSGM sector on the one hand, or whether they should prioritise support for the LSGM sector (Figure 5.16).

As indicated, the researcher noted that when faced with key dilemmas, government, the LSGM sector and mining communities are favouring one side over the other (a situation that can be characterised with systems archetype (Senge, 1990) from a CLD perspective although the concept of systems archetype is (not) less emphasised in TOC). In the specific situations highlighted above, government currently focuses on the export potential whilst the LSGM sector promotes functional objectives, with mining communities prioritising support for the ASSGM sector.

6.9.2.2 Concepts of conflict

In this study, a situation involving competing interests is considered as conflict where it involves multiple parties with seemingly conflicting interests. In Table 5.2 for example, it could be noted that different stakeholders with different stakes in the gold mining industry pursue different interests that are out of step with each other or even clash. The study notes that complex situations reflecting conflicts of interest amongst stakeholders of the industry are often being dealt with by favouring one side, leaving the other side dissatisfied as a result of using compromises, trade-off or flip-flop solutions.

For example, one such undesirable situation that can arise is the figure-8-systemic structure or pattern reflected in a CLD as the escalation archetype (Figure 5.12) discussed in Chapter 5. As Kim (1992) describes, drawing on (Senge, 1990), in an escalation scenario, Party A *takes actions* to counter a perceived threat in a system. Party B in the same system perceives the actions of A as creating an unfavourable imbalance in the system, making B feel threatened and hence, responding to close the gap. This supposedly 'gap-closing' action(s) by Party B then pushes us back to the situation where Party A perceives party B's action as a threat, leading to a counter action and causing an escalating Figure-8-pattern.

As a practical example, the researcher notes from Figure 5.24 that 150. *Government uses aggressive fiscal policies (such as ring-fencing/VAT on exploration) to maximise Ghana's economic benefits from gold mining based primarily on a perceived misconduct of mining companies (i.e., 130. It is believed that some companies fail to declare profits to avoid payment of taxes).* This action is perceived by mining companies as causing undesirable effect 180. *Mining companies struggle to achieve their economic goals.* Hence, mining companies tend to respond with counter actions such as 190. *Employees of LSGM sector are faced with repeated episodes of redundancy, particularly during lean seasons of the industry thereby leading to 205. Ghana's economic potential of gold mining sector is not fulfilled* and reinforcing government's perceptions about mining companies and counter actions to maximise Ghana's economic benefits.

The unresolved conflict can also lead to flip-flop solutions. This describes a situation involving switching back and forth between opposite actions (such as centralisation versus decentralisation), but neither action gives complete relief. For example, in the conflict situation represented by the DD' arrow in an EC, action D might be favoured initially, but the outcomes are undesirable, pushing us to take action D', but when we then switch to D', the outcomes push us back towards taking action D. Hence flip-flopping between D and D' over time, an unsatisfactory solution to DD' that we must avoid.

In Chapter 5 for example, the generic EC (Figure 5.16) framed the conflict pointing to seemingly disparate interests of the government, the LSGM sector, and mining communities, and demonstrates the possibility of addressing such conflict.

On the one hand, the B-D arrow, representing the interest of government, implies that government must *Maintain tighter regulatory system (ERSBA)* in order to *improve (minimise) adverse impact of gold mining in Ghana*. On the other hand, the CD' arrow represents the industry's desire that government *implements a facilitative regulatory system* in order to *provide a more favourable business environment*. Specifically, the analysis suggested that government will be better able to achieve its economic development and poverty reduction goal by seeking to find an effective solution to the DD' conflict arrow of the generic EC. An effective solution to the conflict expressed as DD' is not to be confused with finding trade-off between D and D'. Instead, it means addressing the conflict to ensure a win-win outcome for both sets of stakeholders as parties to the conflict.

Indeed, there are situations where applying D or D' respectively may sometimes be necessary. For example, given the growing illegalities and risks associated with the ASSGM sector, it may be best for the government to apply action D. *Maintain tighter regulatory system*, but switch to D'. *Provide a more facilitative regulatory system* once formalisation of the sector has been achieved. By so doing, government would have successfully broken the DD' arrow by applying either side depending on the situation. This approach is consistent with the principles of separation of opposing requirements in space, time, whole/parts and condition (Stratton & Mann, 2003).

However, such decisions must be made in a very controlled way, avoiding the tendency to flip-flop between D and D', or the escalation associated with the Figure-8-pattern CLD discussed above.

Powell describes this controlled harnessing of the DD' conflict, developed and used by Wisetech Global, as 'magic druids' (Powell, 2019), and should be the aim of resolving the EC even if it is an aspirational aim – place to head to – to find the creative tension by resolving the cloud at arrow DD'. However, regarding the generic EC (Figure 5.17), the researcher notes that government currently prioritises the tighter regulatory system (through the ERSBA) framework, compromising the imperative of providing a facilitative regulatory system. By so doing, it has tended to focus more regulatory attention on the LSGM sector with limited attention to formalising the ASSGM sector, leaving the latter to largely operate outside the legal framework, posing a threat to the industry and Ghana as a whole.

The result from the EC analysis of this study and related examples listed in Table 6.2 suggests that the root cause limiting desirable outcomes of the industry is unresolved conflicts or dilemmas. The industry has instead made one-sided decisions and compromises that have tended to favour short-term options at the detriment of longer-term alternatives.

The approach taken by stakeholders of the industry is therefore in direct contrast with the established approach for addressing such situations based on seeking a win-win solution (Cox et al., 2005; Cox & Schleier, 2010). Instead, it reflects a lack of capability to deliver desired outcomes without compromises.

6.9.2.3 What the generic EC implies in practice

The generic EC suggests that the problem limiting desirable outcomes is embedded in the ERSBA framework used for analysing and managing environmental impacts of gold mining in Ghana. As outlined under section 4.2.1.1, the framework was designed under the assumption that LSGM companies cannot be trusted to fulfil their environmental obligations at the end of the project without requiring such companies to make an upfront financial commitment. This assumption is informed by an environmental lesson learned from the misconduct of a multinational gold mining company– hence the ERSBA was created.

The final CRT suggests the ERSBA framework allows for tighter regulation to be built into the project approval process thereby providing a regulatory solution to adverse impacts of the LSGM sector. However, there are a range of unintended consequences that can be attributed to the belief and reliance on the ERSBA framework. For instance, mining in protected forest reserves is currently legitimated because regulators believe that under the ERSBA, LSGM companies can now be trusted to meet their environmental obligations (section 4.2.1.2). But remediation can never truly repair damage to protected forests.

Secondly, mining communities cannot guarantee their support and commitment for mining companies partly because, under the ERSBA, decision making about the social and environmental

dimensions is highly centralised. As such, members of mining communities may not be involved in the negotiation processes of aspects that may have a direct bearing on them. Without the involvement of such communities, there is no formal agreement to govern company-community relationships. As a result, most members of mining communities support the ASSGM sector, including Galamsey activities, which contribute to operational conflicts that then cause LSGM sector to struggle to meet their economic goals.

Thirdly, as a result of prioritising the ERSBA to govern agreements with developers from the LSGM sector, the remediation costs and other risks associated with the ASSGM (particularly the Galamsey) sector increases (an unintended consequence). This is because the ASSGM is strictly reserved for Ghanaians, meaning no FDI is attracted to the sector, whilst the ERSBA framework is mainly targeted at the FDI (LSGM) sector. As such, attention to environmental regulation and formalisation of the ASSGM sector is not given the needed attention, allowing the sector to engage in illegal activities, including unsanctioned mechanised extraction (section 4.4.2.2).

The above findings reflect the view shared by Dettmer (2003) that problems with system underperformance are not infrequently caused by a self-imposed policy; they are not always caused by an external factor. Having discussed key aspects of the EC approach, Table 6.2 lists 12 EC's identified during this research, comprising 4 that have been addressed and 8 left for future study.

Table 6.5: A summary of complex situations framed in the language of the EC

AB & AC arrows				BD arrow	CD* arrow	DD* arrow	Status
Item	Objective (A)	Requirement (B)	Requirement (C)	Prerequisite (D)	Prerequisite (D')	Current Action is: (Prerequisite D)	-
1	Ghana must maximise benefit from gold mining now and in the future	Gov't must attract FDI Funds	Gov't needs development of local capacity/capability	Gov't must focus on the export potential	Gov't must focus on the local potential	Gov't focuses on the export potential	Addressed by this study.
2	Ghana must address illegal ASSGM activities to realise full potential	Gov't must avoid leakages/illegal operations/environmental damage	Government needs formalisation of the ASSGM sector	Gov't must ban Galamsey activities	Government must not ban Galamsey activities	Gov't has taken steps to ban Galamsey	Future study required.
3	Government must maximise benefit from gold mining now and in the future	Gov't must satisfy present economic needs/interests	Gov't needs to protect the interest of future generations	Gov't must allow mining in forest reserves	Gov't must not allow mining in forest reserves	Gov't allows mining in forest reserves	Future study required.
4	Government must maximise revenues from gold mining now and in the future	Gov't must ensure effective implementation of the fiscal regime	Gov't must ensure to develop an effective fiscal regime	Gov't must prioritise ring-fencing of projects	Gov't must not prioritise ring-fencing of projects	Current approach: Gov't prioritises ring-fencing of projects	Future study required.
5	Ghana must maximise revenues from gold mining now and in the future	Gov't need to protect against abusive use of stability agreement	Gov't must ensure resilience of mining companies	Gov't ought to limit the use of mine stability agreement	Gov't must not limit the use of mine stability agreement	Currently government limits the use of mine stability agreement	Future study required.

Table 6.5 Continued

6	Ghana must maximise revenues from gold mining now and in the future	Gov't must ensure development of individual Ghanaian capability	Gov't must ensure development of a national capability/ capacity	Gov't must issue mining permit to individuals	Gov't must not issue mining permit to individuals	Currently Gov't maintains mining permits to individuals	Future study required.
7	Ghana must maximise revenues from gold mining now and in the future	Gov't ensure compliance to local content (procurement) policies in Ghana	Gov't must ensure to increase the number of tiers of local suppliers in Ghana	Gov't prioritise reliance on companies to develop local industries	Gov't must prioritise reliance on its own effort to develop local industries	Currently government prioritises reliance on companies to develop local industries	Future study required.
8	Government must maximise Ghana's benefit from gold mining, now and in the future	Gov't ensure it complies with terms/ conditions of FDI capital	Gov't must ensure to invest in mining operations/sh are investment risks	Gov't must maintain limited involvement and ownership	Gov't must not maintain limited involvement and ownership	Currently Ghana's ownership is limited by at most 10% free equity stake	Future study required.
9	Companies must ultimately make more money, now and in the future	LSGM companies need to work within operating budget	LSGM companies must ensure to be operationally effective	LSGM companies must pursue functional objectives	LSGM companies must not pursue functional objectives	Currently LSGM sector pursues functional objectives	Addresed by this study
10	Companies must be resilient, now and in the future.	companies must Ensure to utilise resources efficiently	Companies need to Have improved productivity	companies must Consider excess capacity of skilled/ experienced labour as worthless	Companies must Consider excess capacity of skilled/ experienced labour as worthwhile	Currently Companies Consider excess capacity of skilled/experie need labour as worthless	Future study required.
11	Mining communities seek to have improved overall wellbeing	Mining communities must have practical source of income and employment	Mining communities must ensure development of social infrastructure /avoid degradation/ pollution	Mining communities must prioritise support for ASSGM instead of LSGM sector	Mining communities must prioritise support for LSGM instead of ASSGM sector	Currently Mining communities support ASSGM activities	Addresed by this study
The Generic EC	Ghana must Achieve economic development and poverty reduction from gold mining	Gov't needs to improve impact (reduce negative impacts of gold mining	Gov't need to provide a more favourable business environment	Gov't must maintain tighter regulatory system (ERSBA)	Gov't must maintain a facilitative regulatory system	Currently Gov't maintains a tighter regulatory system	Addresed by this study

6.9.3 The Goal Tree (GT)

Human-built systems are generally created to achieve some goal which sets the direction and milestones for assessing performance (Dettmer, 2003). However, the CRT of this study indicates that each stakeholder of the gold mining industry in Ghana currently prioritises their own interest, suggesting that there is no common goal to guide the performance of the industry (Figure 5.23). Using the goal tree approach, the researcher proposed an overall goal and identified critical success factors (CSFs) and necessary conditions (NCs) that must be met in order to achieve that goal, based on the literature and participant viewpoints. The resulting GT was provided in section 5.7 in Figure 5.26. The overall goal is to ensure that: *“Ghanaian stakeholders’ outcomes are improved, now and in the future.* As can be seen, this goal is set at the system level. However, it is important to note that the definition of Ghanaian stakeholders in the context of this study goes beyond the boundary

of the functional (traditional) connotation of the phrase. Instead, it includes multinational LSGM companies and foreign-owned service support businesses based in Ghana. It is important to note that all stakeholders, including Galamsey operators and vulnerable stakeholders – women, children, peasant farmers and the disabled – all have a role to play towards achieving the goal. Their involvement is not to be downplayed.

The goal, and CSFs and NCs that must be met to ensure its achievement, can be verbalised using Table 6.6 as follows. It is important to note that although determining the goal through the GT process takes a top-down approach, implementation must be approached from the bottom-up. This means that NC14 and NC15 must be met to advance to NC11. Also, NC11, NC21 NC13 must be enabled to deliver NC7, NC9 and N10 respectively. Similarly, NC7 must be met to enable NC1 towards CSF1; NC8 through NC2 deliver CSF2 which is also made possible by fulfilling NC3 and NC4. Finally, CSF3 is activated through NC5 and NC6.

Table 6.6: Goal, CSFs & NCs

Goal	Goal: Ghanaians stakeholders’ outcomes are improved, now and in the future						
Critical success factors	CSF1: Companies’ productivity/profitability is improved.		CSF2: Deliver desired outcomes for all stakeholders without compromises.			CSF3: Focus on systems goal(s).	
Necessary conditions	NC1: Companies have competitive cost structure (OPEX and CAPEX).		NC2: We get benefits from mining operations.	NC3: Equitable benefits to the people, companies, and gov’t now.	NC4: Equitable benefits to the people, companies, and gov’t in the future.	NC5: A well-established win-win culture.	NC6: Collective effort of stakeholders.
	NC7: Cost (AISC) is reduced as much as possible.		NC8: Mining operations impacts our lives in more positive ways.	NC9: A satisfactory solution to conflicts of interest amongst stakeholders.		NC10: Meaningful engagement driven by a win-win bargain.	
	NC11: Domestic Capacity is strengthened.		-	NC12: Recognise conflict of interest situations and be aware that solution is possible.		NC13: Stakeholder management capability is improved.	
	NC14: Local consumption of gold is promoted	NC15: Number of tiers of local suppliers in Ghana is increased.	-				

6.9.4 The FRT for mapping the future reality

In Chapter 5, the current reality tree (CRT), split into three (3) fragments (Figure 5.23, 5.24 and 5.25) for discussion, and was developed from the Generic EC following the EC process (involving the surfacing of assumptions and injections) for core dilemmas at the national, firm and community levels.

However, the FRT and PRT were deferred at that stage, so they could draw on findings not only from the CRT/EC but also the non-TOC frames. This section demonstrates the significance of the FRT in making decisions about the future.

Like the CLD, the FRT has the importance of making decision makers proactively aware and confident about proposed actions prior to implementing them. In line with the GT where the *goal is to ensure that Ghanaian stakeholders' outcomes are improved, now and in the future*, the FRT is intended to check whether 215. *Benefits for Stakeholders (State, communities & investors) fall short of expectations (i.e. the overall UDE) from the CRT*, will be overturned by the injections or actions.

Developing the FRT benefited from insights from the field study, and from the various analytical frames, which are summarised next.

6.9.4.1 A quick reflection on recommendations for change from the field study

Some national-level sources suggested the government needs to change from focusing on gold (for economic development in Ghana) to focusing on the development of other economic sectors that do not depend on gold for raw material input (section 4.4.1.4). The key argument is that the reliance on gold for economic development is contributing to a growing dependence on overseas capacity, and the collapse of local alternatives. Economic sustainability seems to be a key motivation that underlies the above prescription for change.

Another source insisted that the need to change from being export-driven is overdue (section 4.4.1.1); the export-driven model is a colonial legacy, inappropriate for economic development, and needs replacing with a more effective alternative.

Another stakeholder with an interest in jewellery making implied that government should change its focus on exporting gold to local consumption of gold.

A leading industry expert suggested the need to change from small-scale to medium-scale mining and from individual to collaborative and cooperative systems (section 4.4.2.1). A common view from the firm level is that there is a need to make the regulatory environment more facilitative for mining companies in Ghana. Key complaints included the charging of a 15% VAT on exploration, and ring-fencing, which make it difficult for companies to succeed (section 4.3.3.1). A community-level viewpoint echoed this, saying, “Communities and government should come together and bring the mining companies on board so that we all discuss and know the way forward and how

best to get there” (section 4.2.2.5). Whilst the above views are important, it must be noted that basing our solutions on suggestions alone could lead us to flip-flop situation.

Hence, the researcher applied relevant TOC tools that allowed us to fully analyse these and other insights, coming up with appropriate solutions. These solutions must be subjected to further testing using the FRT as demonstrated in Figure 6.3).

6.9.4.2 Injections, outcomes and actions – insight from the analytical frames

Three (3) main injections from the EC process will be analysed in relation to addressing the question of “*what to change to*” in the CSQ. This means that the FRT builds on the CRT process which allowed us to answer the “*what needs to change*” question, and complements the EC, leading to recommendations (injections) for the future. The FRT also includes injections to address/prevent unintended consequences that may arise.

Table 6.7 lists the desirable effect and the 3 main injections from the EC which formed the basis for applying the FRT. Also highlighted are the list of potential negative effects (NE)/ (NE’s for plural) that would arise in absence of further injections to facilitate successful achievement of the desired effect.

Hence, the “Actions” column in the Table provides a list of extra actions required to remedy these identified NEs. Finally, the “Common objectives” refer to “side A” of the EC analysis completed in Chapter 5. Table 6.7 thus, provides 3 injections proposed for implementation, identifies potential NE’s (Negative Branch) that can arise, offer actions that are necessary to prevent or mitigate the potential NE’s in the future as a result of the planned injections. Note that the Actions are equally injections but distinguished from the 3 main injections under the column coded blue. They emerged as solutions to counter unintended consequences resulting from the primary injections.

The researcher has left the potential negative effects (labelled Overcome) in the FRT. This is not part of the normal FRT convention but was thought advantageous to emphasise their importance to the decision makers, so they know why actions are to be taken. The resulting FRT is provided in Figure 6.3. The FRT shows other entities not listed in Table 6.7 which are also noteworthy. These are the “Preconditions” and “Intermediate Effects”. The concept of preconditions was explained in Chapter 5 (see section 5.6.2).

6.9.4.3 Preconditions, intermediate effects (ImE’s) and desirable effects (DE’s)

The preconditions on the FRT are current realities in the gold mining industry in Ghana. They were imported from the final CRT and play the same role as described earlier. Exception is given to precondition 32. *Stakeholder management capability of industry is poor* – this came about as a result of insights from the stakeholder analysis of this study (see discussion under section 6.6.3). Others such as negative effect 54. *Conflict of interests are not satisfactorily addressed*, similarly constitutes insights from the SA.

Indeed, some of the key insights in the FRT came about through the supply chain analysis (SCA). Key amongst them are injection INJ 3. *Primary sectors linked to the mining industry are mapped, and weak points identified and strengthened*, and potential negative effects such as 61. *Ghana's capacity/capability to undertake value-adding activities linked to gold remains underdeveloped*, and 82. *Ghana's reliance on overseas suppliers compromises supply chain security and integrity, including collapse of local industries and leakages of value*. INJ 2. *Government resolves to extract as much value from the gold ore value chain for Ghana* can also be attributed to insights from several analysis, including the CLD analysis, EC and the value chain (VCA) analyses frames.

With reference to the goal tree (GT) there are a lot of insights captured in the FRT that are linked to the CSFs and NCs captured in the Table 6.6 above. CSF3. Focus on systems goal in the GT is reflected in the FRT as entity 90. Sector can focus on systems goals, for example. Regarding the Intermediate Effects (ImE's), this could be considered desirable effects as well, with the exception of entity 24. *Stakeholder management capability is needed* which can more appropriately be regarded as a requirement.

The rest of the intermediate effects are desired effects. However, they are distinguished from the desirable effects which constitute the end result of the FRT process. As indicated above, the use of “Overcome” in the context of the FRT of this study refers to potential negative effects. (It is also used later in the context of the PRT, referring to obstacles that need to be overcome).

The resulting FRT is provided in Figure 6.3. Having convinced ourselves that the 3 injections would lead to the desired future, this section has contributed to the purpose of this study by helping to address the key question – “what to change to” in the CQS. The next section will consider how to cause the change.

Table 6.7: Main entities in FRT, by type

Desirable Effect	Initial Injections (Solutions)	Potential Negative Effects (NE's)	Additional Actions to prevent potential NE's	Common Objectives
150. Benefits for stakeholders (State, communities & investors) is realised relative to expectations.	INJ1: Stakeholders agree to work together for the collective good.	45. Some companies will be tempted to act badly.	INJ4: Government has a range of penalties, including reinstating ring-fencing, VAT and cancellation of contracts and mining concession.	104. Mining companies can make more money, now and in the future (See Figure 5.15)
	INJ2: Government resolves to extract as much value chain for Ghana as possible.	54. Conflict of Interests are not satisfactorily addressed	INJ5: Government encourages State-Private sector partnerships for development of needed projects in Ghana.	131. Ghana gains more (and more) from the gold mining sector (See Figure 5.14).

	INJ3: Primary sectors linked to the mining industry are mapped, and weak points identified and strengthened.	55. The original agreement to work together is breached.	INJ6: People are trained in systems-based tools (such as TOC thinking process tools) that allow them to capture complexity and manage conflict of interests as simply as possible.	135. Overall wellbeing of mining communities can be achieved, now and in the future (See Figure 5.16)
	-	61. Ghana's capacity/capability to undertake value adding activities linked to gold remain underdeveloped.	INJ7: Stakeholders are aware of other's priorities and their own one in harmony.	140. Ghana's economic development and poverty reduction can be achieved and sustained (See Figure 5.17).
	-	70. Sector remains internally focused.	-	-
		82. Ghana's reliance on overseas supplier(s) compromises supply chain security and integrity, including collapse of local industries and leakages of value		

It must be noted that the resulting diagram (Figure 6.3) is an indicative FRT in the sense that it would need checking with participants/stakeholders for their reservations and adjusted until it provides them confidence to move forward. Checking with stakeholders for reservations and necessary adjustment is also recommended in case the injections, solutions or actions proposed by this study seem challenging. The PRT is for that purpose.

Figure 6.3: Indicative future reality tree for gold mining industry in Ghana

6.9.5 The PRT for executing the change

As demonstrated above, the FRT sought to test whether the proposed injections look effective in leading to the desired future where stakeholders may consider it feasible to implement these injections. This section seeks to demonstrate how to cause the required future using the prerequisite tree (PRT), a necessity-based logic, to demonstrate the practicality of managing three main changes recommended by this study.

Hence, three (3) prerequisite trees, one each for the recommended changes are demonstrated. Completion of this section thus, addresses the question of how to cause the change in the change question sequence.

Traditionally, the PRT is often approached following the structure illustrated in Figure 3.9. This study takes an alternative approach consistent with the approach used in “Flying Logic” thinking process software (McNally, n.d.). Here we use the “Overcome” and “Milestone” labels to denote respectively the “Obstacles” and “Intermediate Objectives” used in the traditional PRT approach.

Table 6.8 below provides a list of issues to overcome (obstacles) and the corresponding milestones (intermediate objectives), in order to cause the change to raise outcomes for stakeholders, now and in the future. Note that this target relates to the GT (Figure 5.26) with critical success factors, and necessary conditions listed in Table 6.6 above. It also relates to injection 01. *Stakeholders agree to work together for the collective good.*

Hence, by developing a PRT for the Target in Table 6.8, this would have demonstrated how to cause the change intended by injection 01 as one of the main recommendations from the EC process.

The resulting PRT is provided in Figure 6.4. Consistent with the TOCICO Dictionary (2012, pp. 136-137), the PRT can be read, starting from the overall objective (target) to the bottom (i.e., starting from the steps that must have been achieved to implement the required change. However, implementation starts from the bottom-up. Appendix 9 provides an IO map – without obstacles as the road map or plan of implementation for PRT.

To illustrate, in order to implement change to raise outcomes for all Ghanaian stakeholders, now and in the future, we must achieve milestone 1a and 1b, and 1c and 1e in order to break or overcome obstacle 1: *Everybody is thinking about themselves* as shown in Figure 6.3 below. Indeed, some of the milestones listed are sufficiently challenging that they may require another PRT (beyond the scope of this study).

Table 6.8: List of obstacles & intermediate objectives for PRT 1:
Raise outcome for all Ghanaian stakeholders

Target: Implement change to raise outcomes for all Ghanaian stakeholders, now and in the future.	
Overcome (Obstacles)	Milestone (Intermediate Objectives)
Obstacle 1: Everybody is thinking about themselves.	IO1a: Stakeholders are committed to the project for their common good. IO1b: Industry is more focused and committed for the common good of stakeholders. IO1c: Industry is capable to pursue systems goals. IO1d: No stakeholder prioritises its own interest. IO1e: Stakeholders can capture and manage complexity more effectively.
Obstacle 2: No common goal to guide the priorities of stakeholders.	IO2: Stakeholders are aware of other's priorities and set their own ones in harmony.
Obstacle 3: There is limited understanding on how to deal with conflict of interest situations.	IO3a: We are familiar with tools that allow us to cause the change. IO3b: People are trained to use TOC tools.
Obstacle 4: We lack exposure to suitable tools such as TOC to guide us.	IO4: We contract TOC experts to train people.
Obstacle 5: So many goals being pursued by different stakeholders.	IO5: Stakeholder value creation is made the ultimate goal of the industry.
Obstacle 6: Difficulty to transition from knowledge to practice.	IO6: Decision makers identify and address problems more effectively.
Obstacle 7: Arms-length relationship amongst stakeholders exist.	IO7: Stakeholders are encouraged and motivated to share their views.
Obstacle 8: Communication and information does not flow easily amongst Ghanaian stakeholders.	IO8a: We have relevant feedback and feedforward systems in place. IO8b: Feedback and feedforward systems are easily accessible to the people.
Obstacle 9: Trust and cooperation amongst stakeholders is lacking.	IO5: <i>See above.</i>

It must be noted that similar to the FRT of this study, the PRT diagrams are indicative, providing a skeleton on which concerns of key stakeholders can be incorporated. It would therefore be necessary to check with relevant stakeholders for their reservations and needed adjustments prior to implementation. An implementation map or plan for each of the PRT is provided in Appendix (see Appendix 9, 10 and 11).

The second and third PRT of this study are considered next following presentation of PRT 1 as in Figure 6.4 below. A key insight from the PRT analysis process is that any change is possible if the right protocols are followed. The PRT process can provide the gold mining industry in Ghana with the right protocols that if considered could help to cause any change that must be implemented to advance any future that it desires. This include, in addition to the changes recommended by this study, others such as changes that must be implemented to ensure formalisation of the ASSGM sector.

Figure 6.4: Indicative PRT 1 – Implement change to raise outcomes for all Ghanaian stakeholders

Table 6.9: List of obstacles & milestones for PRT 2:
Change from export of unrefined gold to export of finished gold products

Target: Implement change from exporting unrefined gold to exporting finished gold products by 2030	
Overcome (obstacles)	Milestone (Intermediate Objectives)
Obstacle 1: Current system is designed to allow for export of gold up to 100%.	IO1: Create a viable system that encourages focus on local consumption.
Obstacle 2: Government fears to lose significant amount of fiscal revenues as a result of the change.	IO2: Government is more determined and focused.
Obstacle 3: Industry is characterised with win-lose relationship amongst Ghanaian stakeholders.	IO3: Make the change beneficial to all Ghanaian stakeholders of the industry (including multinational mining companies).
Obstacle 4: Market infrastructure is lacking in Ghana.	IO4: Empower PMMC and the financial services sector to provide needed infrastructure.
Obstacle 5: Ghana has a very limited market for gold.	IO5a: Increase the size of gold market in Ghana. IO5b: Consumers are patronising made in Ghana gold products.
Obstacle 6: Project can be abandoned by next government in the event the incumbent leaves office prior to completion.	IO6: Establish a national action plan that holds all political parties accountable and ensures cross-party support.
Obstacle 7: Stakeholders (including mining sector policy decision makers, managers and political parties) lack the ability to identify and effectively address conflicts of interest	IO7: Stakeholders including (political, mining sector decision makers, and managers...) understand correct problem identification and solution.
Obstacle 8: LSGM companies have existing contractual agreements that run into the future.	IO8: LSGM sector is allowed to prepare for the change.
Obstacle 9: Non-monetary value of gold has deteriorated over time following colonisation.	IO9: Restore cultural, psychological & emotional value of gold to strengthen demand.
Obstacle 10: Importers are bringing in low price, sub-standard gold products particularly from Asia and UAE.	IO10: The public in general and importers of gold products in particular, are effectively educated about the change (highlighting the benefits to them).
Obstacle 11: Winner takes all political mentality is the order of the day.	IO11: Put functional politics aside for the greater good of Ghana.
Obstacle 12: Ghana's capability/capacity for domestic investment is generally limited.	IO12a: Government recognises the need to start with available resources. IO12b: Government encourages state-private sector partnerships for development of needed infrastructure.
Obstacle 13: We need suitable tools that can allow us to capture and manage complexity as simply as possible.	IO13: People are trained in systems-based tools (such as TOC thinking process tools) that allow us to capture complexity and manage conflicts of interest as simple as possible.
Obstacle 14: ASSGM is largely operating outside formal framework.	IO14: Start from the ASSGM sector.

Figure 6.5: Indicative PRT 2 – Implement change to export refined gold products

Table 6.10: List of obstacles & milestones for PRT 3: Change to improve primary sectors' support for competitiveness of mining industry in Ghana.

Target: Implement change to improve competitiveness of primary sectors to support the gold mining industry in Ghana by 2030	
Overcome (obstacles)	Milestone (Intermediate Objectives)
Obstacle 1: Nobody is currently managing the entire supply/value chain.	IO1: We have decided to increase the number of tiers of local suppliers in Ghana.
Obstacle 2: Most state-owned economic activities linked to the gold industry are not well-managed/left to collapse.	IO2: We have revived state-owned sectors linked to the gold industry that have collapsed.
Obstacle 3: It costs industry more to use local suppliers in Ghana than overseas suppliers.	IO3: Local suppliers in Ghana are cost competitive.
Obstacle 4: There is underutilisation of available capacity in Ghana.	IO4: We decide to utilise available capacity (particularly, the Ghana geological survey authority, George Grant university of mines and technology, and many others) more effectively.
Obstacle 5: We already have a list of items that industry is by law, required to purchase from local suppliers in Ghana.	IO5: We recognised the need for a supply chain/value chain approach.
Obstacle 6: Poor attitude of people towards state-owned economic activities in Ghana.	IO6: We have the right people trained, encouraged and supported, and held more accountable.
Obstacle 7: Customs duties are involved.	IO7: Cost of goods and services in Ghana is reduced.
Obstacle 8: Existing contracts between government and mining companies run into the future.	IO8a: Government agrees with mining companies to renegotiate contracts. IO8b: Government decides to start with Medium-scale partnership projects with private Ghanaian mining investors.
Obstacle 9: Linkage opportunities are not well-understood/not fully exploited.	IO9: Categorise mining consumables into at least 3 portfolios: (i) those that have most of the raw materials in Ghana, (ii) those that need to be attracted and (iii) those that can be imported.
Obstacle 10: Politics and power is a key issue.	IO10: Select people based on merit, not based on political colours.
Obstacle 11: Most items purchased from local suppliers in Ghana are sourced from overseas.	IO11: Strengthen the supply chain of primary sectors linked to mining industry to manufacture most mining consumables in Ghana.
Obstacle 12a: There is limited understanding about opportunities in backwards linkages.	IO12: Map the supply chain of specific items consumed by the mining.
Obstacle 13: We don't have many mining consumables that have raw materials in Ghana.	
Obstacle 14: We don't know where to start and how.

Figure 6.6: Indicative PRT 3 Implementing change to strengthen primary sectors' support for competitive advantage

6.10 The utility of multi-framing as an analytical approach

As indicated earlier, Davies and Mabin (2001b) recommend the use of the multi-framing approach for complex problems for which a single frame is inadequate. This section reflects on the application of multi-framing by this study. It approaches this by outlining key examples and reflecting on the utility of multi-framing as an approach/method used by this study. By so doing, the utility of the multi-framing approach will be determined. The section concludes by describing the emergent property of the multi-framing approach used in this study.

6.10.1 Multi-framing examples in this context

In the context of this study, multi-framing can be considered by comparing the depth of complexity captured, the nature and implications of problems revealed, and the breadth of solution offered. Although all the tools used in the multi-framing analysis in the context of this study captured complexity in some critical depth (including EC, CRT, and CLD) we will limit our discussion on the stakeholder analysis and SCA in considering the *depth of complexity*. This helps to offer a more detailed discussion on the topic. Following this, the next two topics (i.e. *the nature and implication for problem revealed*, and *breadth of solution*) are approached by way of synthesising and covering all the tools as applicable.

6.10.2 The depth of complexity captured

The stakeholder analysis informed who the stakeholders are and what they are seeking to achieve, whereby conflict of interests become more obvious. However, it could not have captured the complexity of stakeholders involved in the critical detail achieved in stakeholder analysis in the context of this study without being complemented with other frames.

To illustrate, Famiyeh (2017) traditionally approached stakeholder analysis with an intent to offer a comprehensive understanding about the mining industry in West Africa, including Ghana. In this context, a stakeholder analysis frame allowed Famiyeh (2017) to spot internal stakeholders only. For instance, he indicated in his findings that:

“...the key stakeholders for a mining project are the Environmental Protection Agency, Minerals Commission, Geological Survey Department, Member of Parliament, the Ministry in charge of mining, Forestry Commission, farmers, Land Commission, non-governmental organisations, Department of Feeder Roads, traditional chiefs, district or municipal assembly and youth associations within the concession area” (Famiyeh, 2017, p. 151)

The above scenario reflects the depth of coverage of complexity that applying a stakeholder analysis offered. Complementing stakeholder analysis with supply chain analysis frame prompted thinking about stakeholders more broadly across the extended/sequential chain of activities involved in value creation from *suppliers at one end of the chain, through extraction to market to final consumers at the other end of the chain*. This made it possible for stakeholder analysis in the context of this study, to capture and analyse key stakeholders in other parts of the industry's SC that is not sufficiently promoted in Ghana and hence, not so obvious to spot otherwise.

This included stakeholders linked to the bullion market, for example. The activities of the stakeholders operating in this market affect and are affected by decisions made about the gold mining industry in Ghana. For example, a well-established relationship between the LSGM mining sector and the key actors within the bullion market may lead to the use of *hedging arrangements* and impact on the ownership of the Ghanaian gold mined in Ghana. Such decisions can also affect the nature of managerial actions and the effectiveness of such actions for outcomes in sound decision making and problem solving about the industry.

Building on the above, the CLD helped to capture and understand complexity in cause-effect relationships, characterise complexity that is non-linear in the form of feedback loops and interactions between such loops, and complexity in terms of the dynamic nature of relationships between feedback loops that is often caused by delays. TOC helped to structure the type of complexity discussed above and attempted to address such issues using logic protocols driven by specific TP tools.

6.10.3 The nature and implication of ‘problem(s)’ revealed

Another example of multi-framing in the context of this study can be considered in terms of what is postulated by the various tools as constituting a fundamental or ‘core’ problem of the gold mining industry in Ghana.

For example, a stakeholder analysis suggested that *conflicts of interest existing in the gold mining industry in Ghana are not satisfactorily resolved*. The stakeholder analysis frame suggests there is an implied lack of capability amongst decision makers within the gold mining industry in Ghana to resolve conflicts, making it challenging to maximise the sector’s outcomes for key stakeholders.

From an SCA frame perspective, the industry is faced with the lack of a system-wide integration of the value-adding activities which has resulted in an implied limited capability to add value locally. Specifically, the SCA revealed *inherent weaknesses in the consumption link* and the *lack of strengthening of local sources of supply in terms of upstream activities* as the core issues limiting desirable outcomes.

A CLD analysis revealed dynamic cause-effect relationships and feedback loops that mirror the archetypes that Senge (1990) observed and that often underlie the complexity of managerial issues. These include the *escalation* and the *shifting the burden* (StB) systems archetypes. The presence of the StB indicates that problems facing stakeholders of the gold mining industry in Ghana are being approached with *short-term (quick-fix) instead of long-term (fundamental) solutions*. This results in a DD’-type conflict situation (which can be a one-party conflict or dilemma, relating to a decision maker’s choice or preference for short-term versus long-term solutions. As demonstrated throughout this study, such situations could be addressed by focussing on the DD’ conflict arrow and effectively breaking that arrow.

With reference to the escalation systems archetype, this evidences the existence of a much bigger, systemic conflict of interest that is driven by *perceptions, actions* and *counter actions* between for

example, government and mining companies, with 2 connected reinforcing loops constituting a vicious cycle. It has many implications, including an implied lack of trust, lack of balance in the system (win-lose), lack of systems focus and lack of collective efforts amongst stakeholders. This can be addressed if just one of the parties (government or FDI capital providers) recognises the need to keep the system in a balance, and ensures this is achieved, in a sense ceasing to fuel the vicious cycle, not only ‘stopping’ the escalation but harnessing its systemic reinforcing structure to ensure the systems behaviour becomes that of a virtuous reinforcing cycle. These are issues that a TOC analysis would also typically identify/focus on.

In terms of TOC analysis frames, an EC analysis represents the problem as a conflict between two necessary conditions required to achieve a desired goal, narrowing it down to a specific conflict (i.e. the regulatory or the ERSBA conflict), namely, on the one hand, government feels pressured to *maintain a tighter regulatory system (ERSBA)* but on other hand, it is compelled to *adopt a facilitative regulatory system* instead. An EC frame also implied that this conflict (i.e. whether to maintain or change the status quo) is driven by *the need to improve impact (reduce negative impacts) of gold mining* and *the need to provide a more favourable business environment in Ghana*, both of which are necessary conditions to achieve a goal (i.e. Government wants to achieve economic development and poverty reduction in Ghana), which is also noteworthy. By implication, the EC analysis suggests that a government level lack of *capability to manage* conflicts of interest without compromise(s) constitutes a fundamental challenge facing the gold mining industry in Ghana to which the sector needs to direct attention and focus.

In illustration of how multi-framing perspectives can be embraced even using a single frame, the researcher notes that the EC approach allowed the researcher to frame issues at the individual level using the internal frame (of say, government, mining companies and mining communities) and subsequently reframe the same issue using an external frame. A key insight resulting from applying the internal versus external frame(s) is that the latter helps to see ourselves as part of the problem whilst the former allows us to blame the problem on others. As such, we note how one frame/perspective may highlight how we see ourselves as part of the problem whereas the other alternative frame may shadow that perspective and emphasise the role of others in creating or perpetuating the problem/conflict.

For example, in relation to item 2 (Table 6.5), drawing from the internal frame of government seems to justify its approach to banning the Galamsey, blaming the problem on Galamsey operators. Constructing an EC incorporating the external frame has the potential to help the government become aware of its own role and contribution to the problem of Galamsey. Hence, using an EC based on the internal frame alone may lead to similar decision-making errors that is common with the use of single-frame analytical approaches. The Generic EC, on the other hand, reflects an external frame of the government. It has the potential to overcome the above limitation by providing a ‘bigger picture’ or wider systems view and consequently revealing the actual problem facing the industry. This property of the EC (allowing for framing and reframing) is thus found to be particularly helpful and insightful.

Also, the application of the TOC CRT analytical tool further developed understanding and insights about the ultimate ‘problem(s)’. The CRT analysis resulted in digging further to reveal assumptions underlying the ERSBA conflict emphasised by the EC as constituting the fundamental ‘problem’ of the industry. By digging deep into the assumptions that drive the ERSBA conflict, the application of CRT revealed the *lack of collective effort or the presence of win-lose relationships among stakeholders* of the gold mining industry in Ghana as the core (root-cause) ‘problem’ of the industry. By implication, the CRT perspective indicates that in seeking to improve outcomes for stakeholders of the gold mining industry in Ghana, we must pay more attention to identifying and addressing the root cause.

6.10.4 Breadth of solutions offered

Another typical example of multi-framing in the context of this study can be considered by synthesising insights generated about the solutions directly (or indirectly) offered by each of the multi-framing analytical frames of this study.

In terms of the breadth of solution(s) offered, a stakeholder analysis such as recommended by Elias et al. (2002) typically emphasises the need for systemic solutions, and starts with a thorough understanding of stakeholders depending on the project at hand, then establishes a structured process for meaningful engagement with such stakeholders, promoting transactional relationships amongst stakeholders.

However, as a key limitation, *a stakeholder analysis frame assumes that conflicts of interest amongst stakeholders could be resolved through dialogue*. It does not take into account the underlying (hidden assumptions) that may be contributing to such conflicts of interest that ‘unguided dialogue’ alone may not resolve. As a consequence, relying on a stakeholder analysis may result in addressing problem symptoms, and may lead to costly remedial actions after resurfacing other symptomatic features of the hidden problem(s) over time.

However, by complementing the use of stakeholder analysis with the TOC (EC) we can overcome this weakness. As demonstrated in Chapter 5 and discussed in-depth in this chapter, the EC is designed to more specifically address conflicts (Goldratt, 1994). This makes the EC and perspectives such as stakeholder analysis complement each other to yield a more effective problematising process leading to actionable solutions.

Similarly, the SCA implied that in order to capture more benefit from the gold mining industry, Government needs to strengthen the capacity of the local supply chain to contribute to the industry and reap more benefits as a result. This includes *increasing the number of tiers of local Ghanaian suppliers linked to the industry and increasing local consumption of gold in Ghana*.

Indeed, the Government in Ghana has demonstrated its awareness of SC issues, especially supply chain security and supply chain integrity, passing legislation that seeks to ensure that specific SC operations remain in Ghana, as evident in Nickerson and Geipel (2018). The *list of items legislated for local procurement* (see Table 6.1) provides additional evidence in this regard. Additionally,

Government is asking for producing member companies of the Chamber of Mines to *have about 30 percent of output from the LSGM sector refined in Ghana* (Ghana Chamber of Mines, 2019). Nevertheless, like stakeholder analysis, SCA is not without shortcomings. For example, it provides rich description of vertical and horizontal relationships from end-to-end of the mining system. However, it seems to lack a means of providing practical consideration about the consequences that an imperative such as a *focus on localised economic development*, as intended by the Government of Ghana for example, may have on the dynamics in the gold mining industry. By contrast, the EC approach is both representational and oriented to problem solution or conflict resolution. Applying the EC resulted in injections that finally led to the application of PRT, allowing this study to identify obstacles (constraints) that must be addressed in order to achieve the target, and intermediate objectives to overcome such obstacles to successfully transition from export to a consumption economy of gold as the SCA implies we must do. Such obstacles and IOs could not have been identified using the SCA alone. See Figure 6.4 to 6.6 for examples of PRT resulting from this study. Thus the PRT is distinct by its unique focusing power in terms making us to start any change initiative by identifying obstacles and deciding how best to overcome them.

Indeed, the CLD approach was also found useful in providing further complementary perspectives. As discussed earlier (Section 6.8), the CLD analysis helps us understand the effect that a *focus on localised economic development* can have on industry dynamics, including a *focus on the export potential*. In doing so, the CLD helps to identify key conflicts, including the Figure-8-type conflict situation, although it is not specifically designed to provide solutions to the identified conflicts.

Again, an EC is designed specifically for resolving conflicts, to be used along with the other TOC thinking process tools, for such aspects of problem solving in complex situations. Hence, the EC can complement the CLD approach in addressing inherent weaknesses of the SC/VC analyses for a more effective solution. In addition, the value of complementing the EC and CRT built in to the CQS has been demonstrated.

Iterating between the CRT and the CLD process resulted in further complementary benefits, with variables listed in the provisional CLD (Appendix 7) appearing as entities in the final CRT, a typical example being entity 02. *The ability of gov't to realise more economic gains depends on the ability of mining companies to realise their economic goals*. This variable constitutes a precondition, complementing entity 180. *Mining companies struggle to achieve their economic goals* to appreciate effect 250. *Ghana's economic potential of gold mining sector is not fulfilled* (see Figure 5.24). On other aspect, the link between entities 03 on the CRT – *the ability of mining companies to realise their economic objectives is enhanced by having a favourable business environment* and the generic EC is quite obvious. Thus this resulted from iteration between the EC and the CLD processes.

With regard to the FRT, CRT and the EC, it could be noted that traditionally, these tools are applied sequentially (see Dettmer, 2003, p. 49) without iteration, but with each tool improving/adding to the previous analysis. This study's approach, moving back and forth between frames, allowed

feedback and insights from the FRT into the EC injections after first drawing from a pool of injections offered by the EC to develop the FRT.

For example, initial consideration for breaking the DD' (Figure 5.17) was injection (INJ) 1: *Stakeholders agree to work together for the collective good* (see Table 5.15). However, during the FRT processes insights were gained that led to the realisation of the need for an additional injection (action) to address potential negative effects (NE's) that could occur if INJ is to be considered. Example of these NE's include 45. *Some companies will be tempted to act badly* and 55. *The original agreement to work together is breached*. Reflecting on these issues thus, result in action (INJ 4). *Government has a range of penalties, including reinstating ring-fencing, VAT and cancellation of contracts and mining concession*.

Based on the above insights from the FRT (Figure 6.3), the EC was updated with two more injections to break DD'. These are framed as INJ 2: *Use the ERSBA as pathway to a more facilitative regulatory system - companies that fail the criteria can be made to leave whilst the more socially responsible ones remain* and INJ 3. *Apply tighter regulation to address illegalities in ASSGM sector, and facilitative regulation for more formalised (LSGM) sector* as shown in Table 5.15 in relation to the Generic EC.

In terms of managing the change however, the PRT takes over from the GT and EC. Whereas the GT allowed the researcher to envision the desired future, the PRT helps to manage the transition. The PRT allowed the researcher to surface and overcome obstacles that stand in the way of implementing the recommendations from the supply chain analysis (SCA) for a change towards the strengthening of domestic capacity to add more value locally in Ghana (Figure 6.6 and Figure 6.5). Indeed, the PRT can be used independently. However, in the context of this study, the PRT benefited from insights from the various analytical tools that preceded its development, similar to the FRT.

It could be deduced from PRT 1 for example, that intermediate (IO) 1a: *Stakeholders are committed to the project for their common good* was derived from the generic EC (Figure 5.17). Note that IO1 corresponds to obstacle 1: *Everybody is thinking about themselves* which has link not only to the key insights from the stakeholder analysis of this study but also, to the CRT in terms of entity 05. *There is no collective effort/industry is characterised by win-lose relationships among stakeholders*. Also, that in Figure 6.4, *implementing change to raise outcomes for all Ghanaian stakeholders* has link to critical success factor (CSF) 2: *Deliver desired outcomes for all stakeholders without compromises* (see Table 6.6). Another typical example is IO1c: *Industry is capable to pursue systems goals* which can be linked to CSF3: *Focus on systems goal(s)*. Remember also that insights from the various analytical frames of this study have their basis in insights resulting from viewpoints gleaned from the field study (covered in Chapter 4).

Next, the multi-framing analytical approach of this study is considered.

6.11 Multi-framing as an analytical method/approach

As a general methodological observation, applying each frame helped to *create a different perspective* about the complexity of issues facing the industry, and allowed us to *communicate* those perspectives in ways that differed from one another. Each of these aspects are discussed in turn.

It is interesting to note that whereas the SCA and SA frames captured complexity in a way that characterised the gold mining industry with several problems, the CLM and TOC frames help to add more structure to the problems. Following the stakeholder analysis for example, several issues emerged across the length and breadth of the industry supply chain that could be considered the main problems facing the industry.

However, the application of the concept of CLD as part of the CLM process offered a structured approach to frame the problems using archetypical structures. Building on these, the TOC process further structured the sector's problems into a more fundamental issue that seems to characterise the overall issue facing the gold mining industry in Ghana with a problem that reflects a policy constraint. This then reduces the complexity of issues that must be addressed, and hence allows for the industry to focus and make solution to such problem(s) as easy as possible.

This means that from a TOC perspective, the problem limiting desirable outcomes of the gold mining industry in Ghana does not have to be as complex as the industry's supply chain, nor the multiplicity of its stakeholders. Instead, such modelling provides the route to identifying a relatively small number of problems that can explain the complexity. From the CRT analysis for example, the key problems are tracked down to basic issues, namely:

- 5. *There is no collective effort/industry is characterised by win-lose relationships among stakeholders.*
- 15. *Government encourages FDI firms to address lack of funds for investment/boost foreign exchange earnings.*
- 63. *Sector believes in the traditional logic of management.*

Entity 15 for example, contributes to intermediate effects such as 27. *FDI is attracted to LSGM sector* and hence 43. *No FDI goes to ASSGM sector.*

Over time, these factors result in 191. *Ghana fails to realise potential benefits from the ASSGM sector* thereby leading to 215. *Ghana's economic potential of gold mining sector is not fulfilled.*

This level of understanding of problems offered by the TOC approach helps to offer solutions or actions that are more fundamental, allowing us to overturn undesirable surface symptoms of key problems.

6.11.1 Different frames, different perspectives about complexity

A frame of reference influences perceptions, how knowledge is acquired and used, and informs judgement (Davies & Mabin, 2001b).

Thus a variety of frames is required to capture different aspects, given that no single frame is superior or designed to capture complexity holistically. This is one aspect that makes multi-framing particularly relevant as an approach. Indeed, the efficacy of multi-framing may be considered in terms of the nature and depth of complexity revealed.

In the context of this study, multi-framing provided various analytical frames used to create different perspectives about complexity embedded in the gold mining industry in Ghana. The researcher noted for example that some aspects of complexity in the mining industry were easier to discover than others depending on the specific frame applied to explore the industry.

A stakeholder analysis frame with its systems orientation and its systematic approach to framing stakeholders, their stakes, interests, attributes amongst others, allowed the study to capture complexity of scale (in terms of the diversity of stakeholder relationships and dynamics) that make up the gold mining industry. As such, it showed that complexity of stakeholders of the gold mining industry may exist in their stakes and interests, decision-making processes, and in the way relationships among stakeholders are managed. However, the researcher notes the level and understanding of complexity revealed by the stakeholder analysis was enhanced using the other complementary frames.

A SCA frame for example helped the researcher to see a world of activities in the extended and sequential chain of operations which have system-wide reach. Capturing complexity this way helped to understand the Ghanaian contributions throughout the chain and revealed value creation opportunities that are currently not being pursued, for example, where value is allowed to leak out.

Both CLD and the TOC analytical tools helped to capture complexity embedded in cause-effect (including non-linear) relationships and placed key variables in the context of how they relate to each other. However, while CLD captured such complexity in the context of feedback loops, in TOC, complexity was captured as conflicting needs/wants using the EC, and as root cause(s) giving rise to surface symptoms, allowing us to appreciate how various key variables relate through the more linear (although occasionally capturing non-linear reinforcing loops (see Figure 5.23 – Figure 5.25) cause-effect and necessary-condition logics of the TOC methodology.

6.11.2 Different frames provide different ways of communicating complexity

As discussed above, some of the tools allowed the researcher to frame complexity in a more descriptive sense whilst others are guided and underpinned using formal logic protocols. Key insights from the various analytical frames can be discussed as follows.

6.11.2.1 The supply chain analytical frame

The supply chain analysis (SCA) presentations quite simply mirror the complexity of time- and logic-based sequential processes and activities diagrammatically via a vertical or horizontal chain of activities. In terms of the SCA frame for example, communicating complexity does not require adherence to conventions for describing logic relations in diagrammatic terms. Likewise, the SCA, allowing this study to frame and reframe understanding about the supply chain in ways that allowed the researcher to appreciate issues and challenges faced by mining companies. A notable issue for the purpose of this study, relates to a surprising high amount of revenues spent on local purchases. Compared to using overseas suppliers, the supply (value) chain analysis suggests that it costs the industry more to use local suppliers than the overseas alternative. This seems quite unreasonable as the opposite should be the case from the researcher's perspective. Such insight promoted the researcher to think about what the underlying driver might be of the issue of lack of competitiveness of local suppliers in Ghana, resulting in further analysis leading to a conclusion that it has to do with the *lack of strengthening of primary industries for local manufacturing and supply of items consumed by the industry in Ghana*. In turn, this understanding and similar insights resulted in recommendations that are encapsulated in the PRT analytical process (Figure 6.4, 6.5 and 6.6) of this study, particularly PRT 2 and 3.

6.11.2.2 The stakeholder analytical frame

A stakeholder analysis (SA) offers a more systematic, well-structured process for communicating complexity as it unfolds through a process of rational, process and transactional phases, each communicating distinct aspects of complexity. For example, a rational-level stakeholder analysis allowed the study to primarily, capture and communicate complexity that is embedded in the map of generic stakeholders, before examining specific stakeholders, their stakes, conflicts of interest. While a well-structured process, it is less formal than the logic, analytical and representational protocols of the TOC tools.

The process-level stakeholder analysis (SA) communicates complexity according to how decision making is approached by stakeholders, whether collectively or in isolation. The same approach can be said about the nature of communication of complexity at the transactional level (i.e., whether collective interests are pursued by stakeholders). These features of stakeholder analysis make the approach especially useful to communicate complexity of relationships along the supply/value chain. The dynamic level stakeholder analysis offered opportunity think and see stakeholders in terms of their salience based on their urgency, legitimacy, and power dynamics over time.

For example, to analyse the salience of women as stakeholders of the mining industry, the stakeholder analysis of this study approached this in the context of the UN sustainable development, allowing the study to appreciate the power, legitimacy, and urgency of this vulnerable stakeholders (women) over time following Ghana's subscription to the UN sustainable development goals agenda.

Additionally, the dynamic-level stakeholder analysis communicates complexity in time and space. For example, a stakeholder group such as women in mining may wield limited power and influence when considered independently. However, analysing the stakes of women considering the context of Ghana's subscription to the 2030 SDGs reveals the complexity of power, urgency, and legitimacy of women as stakeholders of the industry. This is showed in Table 5.8, suggesting that the dynamic level stakeholder analysis can be used to analyse the salience of stakeholders in the context of specific projects. The fact that such factors have increased over time can be captured by the stakeholder mapping process. Where possible, generalisations should be avoided. Note that a more generalised analysis of the salience of women in the context of stakeholders of the mining industry could lead to underestimation of key attributes possessed by women in the context of the UN sustainability agenda.

6.11.2.3 The CLM analytical frame

Like other frames of this study, the role of the CLM managing complexity cannot be over emphasised. Apart from aiding the understanding about systemic dynamics of variables and creating visual impressions through the BoT and CLD approaches, it also brought confidence into the analytical process.

Through the CLD for example, the researcher observed that communicating one aspect of complexity is achieved by time-related feedback loops. For example, in CLD, we gain understanding and insights about our problems, solutions and cause-effect relationships from the feedback loops, and the interpretation of the dynamic relations as they unfold over time. In the context of this study, it is possible to figure out a quick-fix solution to a problem, by paying attention to the structure of feedback loops (Figure 5.13).

By offering a more structured means of visualising and communicating the problems facing the industry, the CLD process resulted in insights that allowed the researcher to gain better understanding from some of the key issues highlighted by, for example, the SCA (particularly, the issue of Ghana's export potential of gold). The resulting insights from the CLD then launched the researcher to the TOC analytical phase with specific issues that needed fuller analysis and understanding using the logical protocols offered by the TP tools.

6.11.2.4 TOC analytical frames

In TOC, mapping of cause-effect relationships is guided strictly by logic protocols depending on the specific TP tool being used. In the context of this study, a range of TOC-TPs tools were applied, each involving a slightly different protocol for communicating complexity based on their purpose and logic. Two of these tools, including the EC and CRT have already been discussed.

Like the CLD, applying the TOC CRT tool allowed the researcher to communicate complexity through cause-effect relationships. Indeed, a CLD also allows us the flexibility to communicate cause-effect relationships in a circular motion to capture feedback in a deliberate fashion. This is less obvious in a CRT where feedback loops tend to be added as an after-thought (see Figure 5.25).

However, unlike CLD, a CRT focuses mainly on communicating cause-effect relationships using a top-down approach or a bottom-up approach that is logic-bound. The researcher applied both top-down and bottom-up approaches in the context of this study.

In this study, the researcher notes that both perspectives are useful and should be used complementarily. The top-down approach seems particularly best for diagnosing likely root cause whilst the bottom-up is appreciated for helping to check whether the causes are sufficient. Indeed, the application of the focused current reality tree (fCRT) approach (Ronen & Pass, 2008) was also demonstrated in Chapter 5 (see Figure 20, 21 and 22). Using the fCRT helped provide a more focused approach to presenting key aspects of the final CRT, and offered the inspiration for presenting Figure 5.23, 5.24 and 5.25 as sub-sets of the final CRT (Appendix 9). Thus clarity in of understanding conveyed by the sub-set of CRTs was impossible to achieve otherwise without having to break the final CRT down as it seemed quite complicated in terms of the number of variables and cause-effect relationships captured.

As suggested earlier, applying the EC allowed the researcher the flexibility to apply an internal and external frame at the individual (see Figure 5.14 to Figure 5.16) and generic (Figure 5.17) levels. For example, the ‘internal’ EC frame of government communicated complexity underlying the prerequisite to *focus on export potential* of gold on the one hand versus the prerequisite to *focus on local potential* on the other hand (Figure 5.14). However, the ‘external’ EC frame of government broadened the frame of reference from thinking about the interest of government to thinking in terms of the collective interest of stakeholders (particularly mining communities and mining companies).

Hence, unlike the ‘internal’ frame, the government’s external EC frame helped to communicate complexity underlying the imperative to *maintain the status quo (tighter regulatory system)* to suit the interest of the government on the one hand versus the need to *change the status quo facilitative regulatory system* in order not to jeopardise the mining companies on the other hand.

Hence, although the EC was applied as a single lens, its practical utility extends beyond a single lens. At the individual level for example, applying the EC allowed the research to think and frame the main objective of the government as: A. *Government must maximise Ghana’s benefits from the gold mining now, and in the future*. However, by allowing for reframing of objectives, requirements, and prerequisites via the 3-cloud approach (TOCICO Dictionary, 2012, p. 71), the researcher’s understanding what is/should be the overall objective of the government evolved (see side A in Figure 5.17). This is verbalised as A. *Government must achieve economic development and poverty reduction from gold mining, now and in the future* and formed. Note that it is this overall objective that formed the base of the final CRT of this study (Figure 5.18).

Thus none of the individual analytical frames could have achieved the analytical rigour, depth, and precision in this study, acting alone, making the multi-framing (*the concept of complementing different frames consistent with their individual and unique protocols*) in the context of this study quite beneficial.

6.12 Description of the emergent multi-framing approach

A key insight from the application of multi-framing in the context of this study relates to the emergent nature of the approach which seems to differ in a noteworthy way from the traditional, more sequential approach as in Davies and Mabin (2001b), Mabin and Davies (2004). The assumption is that different frames allow us to see different aspects about the world. Hence, by a deliberate changing of frames, it is possible to see and interpret a problem in multiple ways, leading to alternative solutions, and ultimately allowing decision makers to craft a robust option.

As reflected, such was the approach the researcher envisioned for operationalising multi-framing in the context of this study. The plan was to apply multi-framing applying the different frames in a systematic, sequential manner to generate complementary insights and understanding about the gold mining industry in Ghana. This would then inform sound decision making and problem solving about the sector and lead to understand of how the industry could be managed more effectively to improve outcomes for key stakeholders.

Indeed, in the context of this study, frames were initially used in a sequence. However, the researcher also iterated between the frames, reinterpreting the data within one frame, with the benefit of insights from another frame. In fact, there were multiple iterations and connections between the frames as shown in Figure 6.7 below. The concept and implications of using the frames in sequence and in iteration are considered next.

6.12.1 Applying the frames in sequence

Typical examples of using the frames in a sequence in this study can be illustrated by the one-dimensional flow from the literature and personal experiences to the goal tree, causal loop diagram, stakeholder analysis, and field study.

Other examples of using the frames in sequence are the movement from the provisional CRT to the field study, then the provisional CRT to the SA frame, and the provisional CRT to the EC frame. The study is also characterised by a sequential flow from the field study, EC and CRT to the FRT frame which in turn informed the PRT.

Using the frames in sequence is additionally highlighted by the movement from the field study to the EC frame; the EC to the CLD frame and vice versa; the goal tree to the PRT frame; and from the SA to SCA through the EC then final CRT, GT through FRT to the PRT frame.

For example, a SA frame prompted the researcher to see a world (in terms of competing interests, and stakes, power and influences) of actors whose primary concern or success may depend on effectively managing the fiduciary relationships for a peaceful co-existence. For example, Government is more interested in maximising Ghana's interest whilst mining companies are seeking to maximise their economic (money making). At the same time, mining communities are being adversely affected by the sector's activities and hence, are more interested in overall wellbeing.

However, once a supply chain (SCA) frame is applied, the researcher began to see and think about the industry in terms of the chain of interconnectedness and interdependencies leading to value creation for stakeholders, the success of which may depend on the ability to keep the individual links connected for the greater good of all members.

As the causal loop modelling frame was applied, it made it possible to visualise dynamic cause-effect relationships, getting the researcher to think in terms of systems archetypes, behaviour over time (BoT) graphs and causal loop diagramming which then allowed for better understanding of the structure of problems, how they play out over time, and leverage points for addressing them.

Then with the switch to the TOC frames, the researcher was prompted to move on from the present and think strategically about the future, viewing the underlying problems as root causes limiting successful achievement of the desired future, and how to address such problems.

6.12.2 Iterating between the frames

With reference to iterating between frames, this refers to the more complex, feedforward and feedback (multi-dimensional) flow of knowledge, of insights and of understanding. These are typified by the feedforward flow of knowledge, insights and understanding from the CLD frame to the provisional CRT and the validation of such issues through the feedback flow from the provisional CRT to the CLD frame. Also, knowledge, insights and understanding gained from the SCA informed the development of the CLD which in turn led to confirmation of the insights from the SCA.

Another instance of iterating between frames is evidenced by the ‘movement’ between the CLD and the SA frames, the latter informing the development of the former, which in iteration served to validate the latter. Additional benefits were achieved by moving from the SA to the SCA frame and using knowledge, insights and understanding gained from it to improve the SA.

To illustrate, the SA informed the SCA analysis by promoting the researcher to think about stakeholders involved in the upstream, internal, and downstream activities. This resulted in the identification of, for example, the local and global market intermediary stakeholder category. In contrast, and as with prior studies such as (Famiyeh, 2017), applying the SA analysis in isolation in the context of this study limited the researcher’s attention to Ghanaian stakeholders of the industry, particularly government, mining communities, and mining companies. Key stakeholders such as the *London Bullion Association* (LBAM) and its member institutions including the likes of the *Macquarie Bank*, *VanEck Vector gold miners ETF*, *Dubai Gold and Commodities Exchange* were not captured (see Table 5.1). Whilst Famiyeh’s (2017) SA study focussed on a restricted set of stakeholders, in this study, it was found complementing SA with SC analysis prompted consideration of a broader set of stakeholders. Thus multi-framing emerged naturally from exploring the relationships between the frameworks in less obvious ways than when limited to a linear sequence as shown in Figure 6.7 below. Here, arrows are used to indicate the flow of knowledge, of insight and of understanding.

Figure 6.7: The emergent multi-framing approach

6.12.3 Multi-framing through organic iteration and cross-fertilisation – a key implication

The application of the frames in this more fluid and iterative manner as described above had another impact. The multi-framing created so many opportunities for cross-fertilisation that it became somewhat organic in character. Organic relationships in this context implies that opportunity to complement frameworks naturally exists amongst the range of analytical tools used in this study. It suggests that the researcher's initial conceptualisation about the complementary nature of frameworks, which is consistent with (Mabin & Davies, 2003; Mabin et al., 2006), is an underestimation of the value and practical utility of the multi-framing approach.

In addition to offering complementary insights, multi-framing also served a confirmatory value in this study. In most instances, the problems surfaced from one frame directly (or indirectly) aligned with or confirmed the insights from another frame, thereby enhancing the reliability of, not only the findings, but the particular frames in use. Unlike an SA frame, a SC analysis provided an opportunity of seeing problems from a broader perspective incorporating issues from three main components parts that constitute the mining system, namely the upstream system, internal, and

downstream linkages. Consequently, applying SC analysis not only contributed to understanding or addressing the question of ‘where’ (location) to look for the problem. Instead, it also helped to understand that the problem limiting desirable outcomes of the industry could be more complex and could extend beyond the internal to external boundaries. The emergent multi-framing approach of this study is provided as Figure 6.7 below.

6.13. Chapter Summary: The Utility of Multi-Framing

This chapter sought to discuss findings from the study and assess the utility of multi-framing as a framework for analysing the complex issues faced by the gold mining industry in Ghana. Discussions of individual analytical frames and what each revealed as constituting the ‘problem(s)’ limiting desired outcomes for stakeholders of the industry was considered in this chapter.

Following this, key examples of multi-framing in the context of this study were offered and observations made about multi-framing as an analytical approach. The researcher notes that in the context of this study, multi-framing offered complementary frames to create different perspectives about complexity and through the development of alternative ‘representations’, served as a vehicle for communicating such perspectives. This enriched the researcher’s understanding about the industry in terms of the systemic structure of the industry; the systemic dynamics within the industry; and root causes of systemic problems within the industry.

Also, whilst there was a considerable overlap in knowledge and insights gained using the different frames, their complementarity provided more rounded views and informed the development of frameworks that are practical and context specific. It is apparent that no one of these tools or frameworks could have captured the whole, nor produced such a range of insights. The resulting combination of frameworks can be used to improve understanding about complexity embedded in relationships, systems and processes at all levels of the industry.

Applying these frameworks would help to improve decision making and problem solving about the industry and ultimately help to improve outcomes for stakeholders. It is apparent that no one of these tools or frameworks could have captured the whole, nor produced such a range of insights.

In addition to offering complementary insights, multi-framing also served a confirmatory value in this study. In many instances, we noted again that insights surfaced from one frame directly (or indirectly) validated the insights from another frame, thereby enhancing the reliability of not only the findings but of the particular frames in use. Applying these frameworks together has provided a better understanding and should help to improve decision making and problem solving about the industry and ultimately help to improve outcomes for stakeholders.

Chapter 7 : Conclusions

This chapter evaluates and elaborates on the implications of findings of the study. After restating the aims/research questions and objectives, it reflects on how framing shaped the researcher's thoughts and understanding towards the purpose of the study, highlighting the sequence followed and outlining key findings. The Chapter then address the contributions of the study by delineating the methodological, theoretical, and practical advances made. Recommendations for practice, and limitations of this study are discussed along with suggestions for future research. The chapter concludes by reiterating the contributions of the study.

7.1 Aims/research questions and objectives

This study sought to develop multi-level, multi-framing perspectives and understanding of the nature, structure and relationships that make up the gold mining industry in Ghana with a view to providing government, political and mining sector policy decision makers, and other interested actors with a platform for understanding of the sector in order to support their decision making about the industry and potentially improve outcomes for key stakeholders.

The study was intended to address identified research gaps by achieving the research objectives as follows:

1. Develop a comprehensive, multi-perspective description and understanding of the nature, structure and relationships that make up the gold mining industry in Ghana.
2. Identify root causes of significant problems facing the gold mining industry in Ghana and offer suggestions for possible alternatives that when implemented could help to overcome such problems.
3. Demonstrate the utility of complementary multiple systems thinking frameworks that can in due course provide government, political and mining sector policy decision makers with a better understanding of the sector in order to support their decision making not only strategically but also operationally and tactically, where necessary.

Specifically, the research set out to meet the above objectives via the following research questions:

- ❖ What is the nature, structure, and relationships that make up the gold mining industry in Ghana?
- ❖ How can decision makers logically analyse (identify and understand), and address significant problems limiting desirable outcomes for the industry?
- ❖ What is the utility of a multi-framing approach in providing a platform for decision making and problem solving about the industry?

7.2 How the above aims/research questions and objectives were approached

This section reflects on how the 3 main research objectives outlined above were approached and to understand whether or not the study addressed the research questions and achieved its aims. This can be considered as follows.

7.2.1 Research objective 1: a comprehensive, multi-perspective analysis of the industry

The researcher sought to achieve the above objective by addressing the research question: what is the nature, structure and relationships that make up the gold industry in Ghana. To address this question, the researcher drew from a range of alternative and complementary systems-based perspectives that provided opportunity to gain knowledge and insights about the industry from one frame and improved his understanding by reframing from another frame.

It is generally recognised that effectively managing complexity (such as characterised by the gold mining industry in Ghana) requires the ability to use multiple frameworks, models or tools to generate a range of perspectives that provide a more rounded understanding of the problem context, even if these perspectives are underpinned by different or even competing paradigms or theories (Jackson, 1999; Mingers & Gill, 1997; Quinn, 1988).

The concept of gaining insights and knowledge about the gold mining industry in Ghana from one frame and improving understanding about the sector by reframing from another frame (multi-framing) is thus consistent with the extant literature. However, it must be emphasised that that multi-framing is conceived differently by different authors in the field. For example, the researcher notes from the literature that, whilst some authors have approached multi-framing using metaphors (Bolman & Deal, 2017; Russo & Schoemaker, 1991), others have approached multi-framing using complementary ST tools in a mix-and-match manner (Mabin & Davies, 2004; Mabin et al., 2006).

The multi-framing approach used to address the research questions and objectives of this study is based on the framework of (Davies & Mabin, 2001b) which emphasises the need to recognise the value of context and the nature of frameworks used. Embracing the authors' recommendation inspired the researcher to recognise the need to provide a voice to stakeholders and allowed the study to involve different stakeholders at different levels of the gold mining industry.

Allowing the diversity of viewpoints of stakeholders to be involved in the study context resulted in generating complementary insights inherent in disparate viewpoints reflecting the socio-fiscal and supply/value chain contexts of the industry. Additionally, the diversity of viewpoints highlighted several issues about the nature, structure and relationships amongst stakeholders, and other characteristics that reflects a general concern that the industry finds it increasingly challenging to maximise benefit for stakeholders.

The resulting insights from the field study also confirmed the complex characteristics highlighted by the contextual literature (including complexity in terms of its extended/sequential operations, its system-wide reach, its multiple stakeholders, and the variety of formal and informal organisations that constitute the industry), call for appropriate frameworks for analysing the sector.

The above characteristics led to the choice of recommended frameworks for the industry study as outlined in Chapter 2 (Table 2.1). These include, stakeholder analysis (SA), supply chain analysis (SCA), systems thinking (ST) using CLD modelling, and TOC analyses.

Embracing the above approaches in a multi-framing manner addressed the research questions and achieved the objectives and led to insights for addressing the question of how we can logically analyse, (identify and understand) and address significant problems limiting desirable outcomes of the industry. Additionally, addressing the above research questions also helped to achieve research objective 2 and 3 of this study, each of which can be considered as follows.

7.2.2 Research objective 2: identification of root cause(s) of significant problems

With reference to objective 2, the main issue of concern is how to understand factors (root causes) that can explain a significant number of issues limiting desirable outcomes of the industry. To address the above issue, a literature-based provisional CRT (Appendix 1) model was developed by the researcher that captured cause-effect relationships between variables embedded in the industry. Following insights from the field study (informed by the provisional CRT), and subjected to further analysis through the STA, SCA, the CLM approach and EC process, a final CRT was developed.

As discussed in Chapter 6, the nature of complexity captured by the provisional CRT, which was developed mainly from assumptions highlighted by the literature, was underestimated compared to the complexity of cause-effect relationships captured by the final CRT. The complex nature of cause-effect relationships limiting outcomes for stakeholders of the gold mining industry in Ghana according to the analysis of this study, has been summarised by the CRT which was developed from the generic EC (Figure 5.17) of this study.

It must be noted that the complex nature of cause-effect relationships embedded in the final CRT (reflecting the complex nature, structure and relationships embedded in the gold mining industry in Ghana) prompted the researcher to find a better way of communicating this issue with the industry. The solution was to apply the focused current reality tree as illustrated in Figure 5.20, Figure 5.21 and Figure 5.22 and subsequently, Figure 5.23, 5.24 and 5.25 (sub-sets of the final CRT) in Chapter 5. Whilst Figure 5.23 was focused on issues specific to the ASSGM sector, Figure 5.24 and Figure 5.21 respectively highlighted issues that relates more specifically to the LSGM sector and more generally, to stakeholders of the industry more generally.

By subjecting findings and insights from the field study to further analyses and understanding the complexity of cause-effect relationships embedded in the industry, the following factors can be considered as root causes that can explain a significant number of issues limiting outcomes of the industry.

Firstly, there is lack of understanding of what it means and of how to deliver desirable outcomes for stakeholders without unnecessary compromise. Secondly, the industry tends to use short-term instead of long-term solutions to key issues limiting desirable outcomes for stakeholders, and

thirdly (and more specifically), the final CRT identifies a prevalence of individual win-lose/zero-sum related behaviours and an attendant lack of collective effort amongst stakeholders as being fundamental problems (or root causes) that can explain the less than desirable outcomes of the gold mining industry in Ghana.

These factors can be illustrated with key examples emerging from use of three main analytical framing tools, namely: the EC, CLD and CRT that provide their related perspectives as follows.

7.2.2.1 The root cause from an EC perspective

The EC analysis identified several factors referred to, above, as root causes, including an implied lack of understanding of conflict, how to resolve it and how to anticipate and avoid adverse consequences. The researcher highlighted a range of examples in the discussion section and demonstrated how to deal with such issues by embracing the EC analytical process. Two examples are provided here as illustration.

- ∞ **Example 1:** Insights from the research shows a desire by (multi-national) large-scale gold mining companies and government alike to minimise adverse impacts and maximise the sector's outcomes for key stakeholders, including those at the community level. However, the research has documented many instances of actions taken to address issues and improve outcomes that have instead resulted in further unresolved dilemmas/paradoxes, failing to achieve desired outcomes.

For example, compensation for adversely affected sources of livelihood is built into the project approval system and honoured by (multi-national) large-scale gold mining companies. However, the analysis of this study reveals that the interest of vulnerable groups of stakeholders, particularly women, children (future generations) and peasant farmers, is being compromised

- ∞ **Example 2:** Insight from the generic EC shows that a key problem limiting desirable outcomes for Ghanaian stakeholders of the industry (including multi-national large-scale mining companies) is embedded in the ERSBA framework for analysing and managing impacts of gold mining in Ghana. The framework was ostensibly designed based on an assumption that LSGM companies cannot be trusted to fulfil their end-of-project environmental obligations without requiring such companies to make an upfront commitment. This assumption is informed by an environmental lesson learned from the misconduct of one multi-national gold mining company - which lesson then resulted in the development of the ERSBA legislation and framework.

The EC analysis suggests that in order to minimise adverse impacts and maximise the sector's outcomes for Ghana, government has become predisposed to prioritise a legislated mandatory approach to regulation, instead of providing companies (LSGM and ASSGM sectors) with a facilitative regulatory environment that would seek to improve outcomes

for stakeholders. However, other legislation allows gold mining in forest reserves, compromising the very essence and social legitimacy of the ERSBA framework.

7.2.2.2 The root cause from a CLD perspective

The CLM approach has also identified instances of situations that suggest that a short-term focus and the use of short-term instead of long-term solutions to problems is limiting desirable outcomes for stakeholders. Two main examples are provided as follows.

- ∞ **Example 1:** Insight from a CLD analysis indicates that government is aware of the related needs for investment to build domestic capacity in general, and of the need to build domestic capacity for investment, in particular. The researcher notes, however, that whilst building domestic capacity for investment is a long-term solution for overall economic success that in the short-term, it will impact and draw on fiscal assets (such as foreign exchange reserves) of Ghana. By contrast, an FDI-based solution has the potential to address government's need for investment capital and to boost/protect fiscal assets in the short-term. However, the longer-term ramifications can be perverse, and may include a growing dependency on FDI capital providers, and a trade-off/subordination of Ghana's future interest to the interests, terms, and requirements of FDI capital providers, and other possible unintended or unwanted expenditures. The research has identified that the government has approached the above situation by increasing the use of and consequent dependence on FDI solutions (short-term), instead of building domestic capability and capacity (long-term) for long-term benefits.
 - Consequently, government continues to rely heavily on capabilities and capacity of large-scale multi-national gold mining companies, prioritising the development of major mining projects over development of the indigenous ASSGM mining sector (local capacity).
 - In turn, the lack of adequate attention/support given to development of the ASSGM sector has resulted in the sector's perception that to improve mining productivity and business outcomes, they must resort to seeking benefits from illegal mechanisation of the sector, exposing Ghana and the mining industry as a whole to environmental sustainability issues and to supply chain security and integrity risks.
- ∞ **Example 2:** The study also notes that to boost foreign exchange reserves, government facilitates export of gold as a commodity (short-term focus) focusing on predominantly commodity export markets. An alternative action of building local consumption and the further development of a value-added domestic production economy for gold in Ghana would provide a longer-term focus on Ghanaian stakeholders, including the multi-national large-scale gold mining companies in Ghana. The researcher noted for example that at least 99% of gold produced in Ghana was exported to overseas refineries in 2018. Interestingly,

the Ghanaian government, through the PMMC, seems to have been the leading exporter of gold and exporting on average more than 1.65 million ounces of gold *annually*, in the years 2016 to 2019. This exceeds the combined total of gold exported *annually* by the top three (3) gold producing companies of the industry who exported a little over 1.4 million ounces (*annually*) on average during the same period. It is also interesting to note that, the over 1.65 million ounces of gold exported by Ghana comes from the ASSGM sector feeding through Ghana's *licensed gold dealers*. However, the ASSGM sector largely operates outside the legal framework (i.e., it is made up of over 95% of Galamsey operations). Using a style of narration derived from CLM, we may describe the relationships as follows.

- ... as more *gold is acquired through licensed gold buying* (short-term focus) the *unintended consequences* (such as *adverse environmental impact of the sector*) increase. As the *need for remediation* increases, *government's expenditure on remediation projects* increases as well. As *expenditure on remediation projects* increases, the *level of government fiscal assets* (through exports of gold) will decrease, creating a growing *need to export gold* in order to boost fiscal assets.
- It is interesting that, in the recent past (Hilson, 2017; Osei, Yeboah, Kumi, & Antoh, 2021), government has responded to issues such as illegal ASSGM activities by placing a ban on unregulated Galamsey activities (reflecting a short-term approach) and then advocating a revised emphasis on community mining (CM) under the supervision of the Inter-Ministerial Committee on Mining (IMCM) (reflecting another quick-fix), rather than focusing on finding a more appropriate means of formalising localised mining (long-term approach). Apart from the potential regulatory conflict this is likely to create between existing regulatory bodies such as the Minerals Commission and the IMCM, the issue of community mining is beset with other notable concerns.

For example, some prominent Chiefs in Ghana, including the Paramount Chief of Akyem Abuakwa Traditional Area, have raised legitimate questions about the sustainability of the CM approach (MyJoyonline, 2019). Seeking to draw parallels between Galamsey operations and CM, they acknowledge issues with CM relating to the over-mining of concessions. In addition, some chiefs have expressed concerns about the unlawful issuing of land for CM by some District Chief Executive Officers (Mahmud, 2020). Indeed, government has demonstrated its desire to address problems facing the gold industry in Ghana to maximise the sector's benefits. As part of this process, it has invited various stakeholders to contribute their views through a national consultative dialogue (UTV Ghana Online, 2021) which is noteworthy.

The researcher notes that whilst approaches such as national dialogue is necessary, it is not a sufficient remedy to deal with the complex problems facing the mining industry in Ghana. Similarly, neither CLM, SCA nor SA are independently sufficient to build the comprehensive analysis and understanding necessary to seek continuous and sustainable improvements to the mining industry system. This is possible through multi-framing such as demonstrated in this study.

- In relation to development of the capability of local (indigenous Ghanaian) suppliers, the analysis reveals that government is increasingly legislating for specific items to be procured locally (short-term focus) without strengthening Ghana's capacity to supply such items locally (long-term focus). Consequently, indigenous Ghanaian suppliers have had to rely on overseas suppliers to supply the mining industry.

7.2.2.3 The root cause from a CRT perspective

The root cause of 'problems' limiting desirable outcomes for stakeholders of the industry, according to a CRT frame, was traced back to key stakeholders of the industry prioritising their own interests.

- ∞ **Example 1:** Here, the analysis reveals that the ability of government to realise its economic goals largely depends on the ability of mining companies to realise their own economic objectives which is enhanced by having a favourable business environment. However, the analysis suggests that government prioritises Ghana's interest, often using legislative measures that seem to constrain the ability of mining companies to achieve their economic (business) goals (particularly) (Multinational) large-scale gold mining companies. These include policies that seek to maximise economic revenues to the state such as ring-fencing of projects and 15% VAT on exploration activities.

7.2.2.4 The root cause implied by the SA and SCA perspectives

In addition to the three factors identified above, the SA analysis revealed the lack of stakeholder management capability of decision makers as the main problem whilst the SCA identified a growing reliance on the export market potential and the lack of focus on domestic-led production and market potential as factors that may constitute a major problem for the industry. These factors are by no means of lesser importance. They informed, and are confirmed by, findings from the EC, CLD and final CRT as discussed above. The lack of stakeholder management capability is confirmed by, for example, findings emerging from the final CRT whilst the focus on export potential and the lack of focus on domestic potential are confirmed by findings from the CLD and EC perspectives.

Next, objective 3 - the utility of the multi-framing approach can also be considered below.

7.2.3 Research objective 3: practical (utility) contribution of multi-framing

To paraphrase Simon et al. (1987), the work of managers, of scientists, of engineers, of lawyers, *of researchers...* is largely the work of bridging the gap between theory-practice through research to impact sound decision making and problem solving about the world to ultimately connect to the desired future.

The utility of multi-framing in the context of this study can be evaluated in terms of the practical contributions and theoretical and methodological advances made. Each of these dimensions can be considered under separate sections as follows.

7.3 Practical contributions

The study contributes to practice through the showcasing of a range of frameworks that can be embraced by key stakeholders, including government and mining sector policy decision makers, industry executives, and representatives of mining communities to inform their approach. Specifically, models have been provided using stakeholder analysis, supply chain analysis, CLM modelling, and TOC analysis. These provide a good starting point or platform for anyone wanting to apply these frameworks in the sector.

Also, the study has gleaned and collated information from a wide variety of *stakeholders* and *past literature* and has been able to provide a series of fresh complementary perspectives on long-standing issues. Crucially, it identified the key *root causes of problems* by digging below the surface of issues that have been previously raised. Government and industry executives may find the result useful by drawing from the findings to explain or re-interpret a significant number of issues facing the industry.

It is anticipated that the platform provided by the multi-framing approach would aid in creating awareness of conflicts and has demonstrated that these could be resolved using the EC process, taking on board different perspectives, thinking across the whole supply chain and meeting both present and future needs. In addition, the approach can provide directions for solution and some specific guidance on how to make the changes needed to improve outcomes.

As shown in Figure 6.3 potential solutions are usually validated using TOC tools like the FRT. But it is useful to also note from the analysis of this study that potential solutions could be validated by means of the causal loop diagrams (CLD) which allows to see short and long-term impacts of today's decisions, inform appropriate changes and thus, minimise the risks of entrapments and remedial actions in advance.

The platform also helps to shed light on the notion of a supply chains and value chains in some fundamental way that remains a missing link in the theory and practice of supply chains, yet critical. Thus the examples of supply chain and value chains demonstrated in this study elucidate and provide better understanding and insights about these concepts. Government would be guided to see numerous opportunities for economic development and poverty reduction that are available within the supply chain than never before.

Similarly, companies would be aided to see mutually beneficial opportunities for collaboration with stakeholders (particularly farmers) to strengthen the supply chain of specific items that are used by the industry. This would, over time, transform CSR of the industry to be mutually beneficial, driven by a supply chain approach, and ensures that the ordinary farmer can make a living by adding value to the industry, improving the economic welfare of the people, and strengthening company-community relations in a very organic and sustainable way.

Thus by helping to elucidate and better understanding of the notion of the supply chain, the platform provided through the multi-framing approach of this study would aid government to improve its focus on local content procurement policies and revolutionise the CSR of the industry for win-win outcomes amongst stakeholders of the industry.

Importantly, critical awareness is created about the complex and dynamic nature of stakeholders, reflecting the differences in their stakes, interests, needs wants, desires, and salience possessed by these different stakeholders, and that such issues could be analysed and effectively managed using a more systematic approach. In this regard, the multi-framing platform would serve a repository for benchmarking that would enhance stakeholder management capability of the industry, inform better analysis and understanding leading to sound decision making about the industry, stimulate relationships and impact on improved outcomes for Ghanaian stakeholders.

Whilst generalisation of findings from a case study is neither intended nor appropriate, the research provides a platform for future researchers to apply the same approach to similar issues of a systemic nature that arise in other sectors in Ghana and elsewhere. For example, with respect to gold extraction/production, the researcher notes the absence of a high-level value chain approach, and that no one is overseeing/managing the gold supply chain in Ghana. There is an implication that Ghana could seek to take responsibility for more of the supply/value chain and foster the sector's operations that are critical to Ghana's need to develop the capability and capacity to grow and distribute benefits from gold mining. The same scenario may apply to other sectors including the cocoa sector where Ghana has the potential to capitalise on the *cocoa supply chain* but seems to have limited understanding of how it could be achieved. Presently, whilst cocoa bean production in Ghana is directed to export commodity markets, chocolate products need to be imported.

The development of Government policy such as the 'Mineral Income Investment fund' (MIIF) offers another example of the seeming unintended consequences of a limited systems and short-term view. For example, whilst the government has sought to raise about USD 500 million investment capital in 2020, it is offering (or forfeiting) the entire stream of gold royalties (including royalties for "gold yet to be discovered").

Without appropriate political intent and commitment, the approval of the MIIF is considered by the researcher to be typical example of responding to broader systemic long-term issues with short-term solutions. In terms of other options and consequences, it can be considered as *trading-off/subordinating Ghana's interest* (particularly its future interest) to the current and ongoing terms and conditions of the providers of such investment capital.

There is therefore opportunity for political and industry decision makers to benefit from the findings of this research and from the showcasing of frameworks that may guide their everyday political decision making to benefit Ghana and its people.

For instance, and moving beyond the mining sector in Ghana to the context of relationships within the Africa Continental Free Trade Area (AfCFTA) – established in 2018, Ghana could benefit greatly from the approach set out in this study by drawing insights from the findings and encouraging the use of a wide range of decision making and problem-solving tools and frameworks displayed by the study.

7.4. Theoretical advances

The study reviewed and systematically organised the relevant literature in a way that exposes inherent weakness in the literature relating to gold mining in Ghana.

A theoretical contribution is also made by contributing to the multi-framing body of knowledge and by extending it to the emergent, cross-fertilised multi-framing approach of this study.

More specifically, the findings contribute to advancing theoretical knowledge and understanding by clarifying misunderstandings or misconceptions about what constitutes the main (core) problems that limit desirable outcomes of the (gold) mining industry in Ghana.

For example, the literature refers to issues such as illegal mining operations (Hilson et al., 2014; Teschner, 2012); operational conflict between LSGM and ASSGM sector (particularly Galamsey operators) (Hilson & Yakovleva, 2007), lack of appropriate mining regime (Ayisi, 2015) lack of effective management of revenues, concern about the lack of integration of mining with other economic sectors (Minerals Commission of Ghana, 2015) among others. These issues were reframed in this study as surface symptoms of deeper root causes.

Additionally, in seeking to answer questions and address gaps specific to the erstwhile supply chain of the industry, the supply chain was reconceptualised, and a framework developed that facilitated an alternative perspective and the development of additional insights. As such, the framework serves both theoretical and practical value.

7.5 Methodological contributions

Prior studies have approached multi-framing using multiple complementary systems thinking (ST) tools in a mix-and-match and sequential manner (Cox et al., 2005; Mabin & Davies, 2004; Mabin et al., 2006; Moore & Mabin, 2014). Building on the work of (Davies & Mabin, 2001b) this study makes a methodological contribution by demonstrating the practicality of an industry-wide multi-framing approach that harnesses an initial ordered sequencing of framing exercises, working down and across layers of various systemic levels of the gold mining industry in Ghana, with findings and insight-led mutually-informing iterative reframing.

Researchers acknowledge the importance of the supply chain approach. However, few studies offer frameworks that can offer adequate guidance from one end of the supply chain to the other

(Lambert & Cooper, 2000; Lambert, Cooper, & Pagh, 1998; Lambert & Enz, 2017). Thus an additional methodological contribution is made by conceptualising a framework for SC that allows for end-to-end coverage from a supply chain perspective (see Figure 5.4).

Within the domain of TOC, scholars and practitioners have often approached FRT by treating desirable effects and negative branches separately (Cox et al., 2005; Dettmer, 1997; Reid & Cormier, 2003). This study approached FRT leaving the negative effects to be overcome, clearly labelled as such, in the FRT. This sends a clear signal to the industry players to expect the anticipated negative effects if they do not carry out the prescribed actions – and tells them what they have to do to avoid them. This should prevent the “checklist approach” often used in response to a consultant’s report, ticking off the easy report recommendations and ignoring the hard ones. Thus this study’s novel approach to including the negative effects in the FRT is offered as a methodological (and practical) contribution.

7.6 Recommendations

Building on analysis and findings from this study, it is possible to offer recommendations that align with the TOC change question sequence, namely: why change, what to change, what to change to, how to cause the change, and how to sustain the change. Each of these questions are addressed as follows.

7.6.1 Why change

As reflected on the goal tree (GT) of this study (Figure 5.26), the industry must ensure that ultimately, ‘*Ghanaian stakeholders’ outcomes are improved*’. The GT further suggests that there are certain critical success factors (CSFs) that must be met in order to achieve the ultimate goal. These include CSF1: ‘*Company productivity/profitability is improved*’; CSF2: ‘*Deliver desired outcome for stakeholders without compromises*’; and CSF3: ‘*Focus on systems goal(s)*’.

Findings from this study reveal that none of the above CSFs are currently achieved because necessary conditions (NCs) needed to meet them are not fulfilled. With reference to CSF1, a range of framing analyses, including CLD analysis, SC analysis and EC analysis of this study, indicate that NC11: ‘*Domestic capacity is strengthened*’ is not fulfilled, making it impossible to meet NC7: ‘*Costs (AISC) is reduced as much as possible*. Hence, the reason CSF1 through NC1: Companies have competitive cost structure is not currently met.

In relation to CSF2, a finding from an EC analysis of this study suggests that NC9: ‘*A satisfactory solution to conflicts of interest amongst stakeholders*’ was not being met. Meanwhile, fulfilling NC9 is required in order to meet intermediate objectives that must be activated to then achieve CSF2, including NC3: ‘*Equitable benefit to the people, companies, and government now*, and NC4: ‘*Equitable benefit to the people, companies and government in the future*. This study notes that none of these NCs are being realised.

Finally, in relation to CSF3: ‘*Focus on systems goals*’ is equally not being achieved. This is due the fact that NC10: ‘*A meaningful engagement driven by a win-win bargain*’ is hardly encouraged.

Additionally, result from the CRT of this study also reveal that indeed, the two main factors – NC5: *A well-established win-win culture*, and NC6: *‘Collective effort of stakeholders’*, which are prerequisites to fulfil CSF3, are also not met. This is largely driven by the lack of fulfilment of NC13: Stakeholder management capability is improved, as the SA analysis of this study revealed.

The above issues clearly suggest that there is a gap between the current reality and the desired future. The need for change is thus justified so as to bridge the existing gap.

7.6.2 What to need change

In terms of what to change, the researcher draws from key findings from a range of tools that suggest that need for change. These include the SCA and CRT analysis frames.

From a supply chain perspective, this study noted that a significant amount (over 99%) of gold produced in Ghana is currently being exported to overseas refineries, reflecting the industry’s Ghana’s focus on export-driven value creation. Whilst the SCA makes explicit the nature of the government role in the supply chain, formal statistics relating to period from 2016 to 2019, reveal the extent to which the government, represented by the PMMC as exporter of gold on behalf of the ASSGM sector, has been the leading individual exporter of gold from Ghana.

The role of government in facilitating legislation for FDI and enabling significant foreign involvement in the mining (extraction and production) sector is a matter worthy of consideration. For some, the benefits from government facilitation of FDI in-flows and from the consequential foreign exchange earnings flowing from PMMC involvement in the global commodity export markets, need to be balanced against the leakages of opportunities to develop local capability throughout the supply chain (SC). Indeed, reinterpreting the SC in terms of these matters highlights the leakage of opportunities that could be capitalised on to strengthen forward linkages in Ghana (particularly the financial system), leakage of opportunities to develop backwards linkages, leakages of opportunities for developing more local (managerial) talent; leakages that reflect an illicit flow of gold particularly through ASSGM supply chain; and leakage through the provision of mine support services by foreign actors.

The SCA therefore brings to light choices about whether to change focus from being commodity export-driven to an alternative that has the potential to address the undesirable side effects of the current system, particularly the issue of leakages.

From a CRT perspective, lack of collective effort/win-lose relationship amongst stakeholders is the key root cause limiting desired outcomes for Ghanaian stakeholders of the industry that needs to change.

7.6.3 What to change to

To address this question, insight was generated from a range of framing tools, particularly the CLD, EC, and FRT. Results from the CLD analysis indicates the need to build Ghana’s capacity for domestic investment. Thus the CLD solution reflects/confirms findings from the SCA that Ghana needs to move away from its focus on gold commodity export markets. However, whilst

neither of the developed CLD or SCA frames capture fundamental risks (such as loss of all the positive outcome) that government could face by changing from being export-driven to focusing on localised economic development, this risk is surfaced via EC processes in the EC frame.

As such, the value of the EC as a complementary frame to the CLD and SCA, is first recognised through its identification of the potential risk associated with the change. The EC analysis then leads to a recommendation that any change to the current system must safeguard, or in the worst case, not sacrifice, positive aspects of the export-driven approach (status quo), whilst changing to localised domestic alternatives (in this case, the increased involvement of domestic organisations in the extraction/production and other parts of the gold supply chain in Ghana).

In view of the insights provided by EC analysis, the researcher concurs with the call for an extension of Ghanaian domestic involvement within the gold sector supply chain. However, the required change must be managed in a manner that will benefit all ‘Ghanaian stakeholders’ of the industry, including multi-national LSGM companies operating in Ghana and the Ghana-based foreign suppliers providing business support services to the industry in Ghana.

With regard to the FRT, it would be important for decision makers to check that the proposed actions will indeed result in the desired future outcomes. Particularly thinking about the possible negative consequences and preventing them through additional injections/actions/interventions, so that the negative effects are avoided or mitigated.

7.6.4 How to cause the change

No desired or necessary change can be possible without effective implementation. To ensure successful implementation of such change(s), the study advocates the use of the PRT tool as a guiding framework. As illustrative evidence of utility and efficacy, the PRT for managing the change to raise outcomes for all Ghanaian stakeholders (Figure 6.4); the PRT for managing the transition from export of raw gold to export of finished products of gold (Figure 6.5); and the corresponding PRT for improving the capacity of primary sectors in Ghana, with the potential to minimise supply chain risks, strengthen competitiveness of local suppliers, and facilitate the achievement of operational efficiency and effectiveness by the industry (Figure 6.6), are provided in Chapter 6 (section 6.9.5). The study further illustrates how Table 6.8, Table 6.9 and Table 6.10 with the accompanying PRTs of Figures 6.4, 6.5 and 6.6, together serve as the implementation plan. However, a more focused plan of implementation for each of these PRTs is further provided in Appendix 10 to Appendix 13. Such planned changes if implemented or enacted in order from the bottom up, would go a long way to address the gap between the current reality (CRT) and the desired future captured by the GT/FRT.

Tables 6.8, 6.9 and 6.10 and their corresponding PRTs, Figures 6.4, 6.5 and 6.6, complete the illustration of how the multi-framing approach, encompassing the TOC five change question sequence, can address the key question of how to cause the change – that is, how to implement and thus prepare the ground for an examination of how to sustain change.

7.6.5 How to sustain the change

As Peter Drucker is famously and incompletely quoted, “what gets measured, gets managed”, implying that what we measure does matter – but not always helpful, not when it is pointless and meaningless, and not if it harms the organisation (Zak, 2013). Put another way using TOC language, measurement is necessary but not sufficient for improvement. In the context of this study, identifying the correct source(s) of the problem and the appropriate steps to address it, and putting in place the appropriate measures for each step, gives prominence to the important factors and enables beneficial management.

Thus a culture of correctly-focused continuous improvement, such as by recognising and embracing the TOC *process of ongoing improvement* (POOGI), is required. The study supports a recommendation that the Change Questions of TOC are borne in mind, and effective utilisation of the TP is encouraged, in order to extend and sustain the benefits of the changes required. Admittedly, TOC thinking process (TOC TP) logic protocols must be understood and internalised to master the TOC approach. However, it is not impossible to learn as evidenced by the fact that the researcher had no prior exposure to the TOC approach. Yet, with effort, determination and right support and guidance, the researcher has been able to gain appreciable knowledge in the field and continue to develop his expertise.

The study suggests that the value of TOC approach for strategic, operational and tactical (managerial) decision making and problem solving, is worthy of commitment to mastery. Indeed, such value is also reflected in how the TOC TP tools have been taught, used and found useful by people across the spectrum, including children, adults, teachers and prison inmates, and by governments and leading organisations (see footnote⁴⁰ for more information).

Moreover, the use of the various systems thinking (ST) methodologies, particularly causal loop modelling (CLM), is highly recommended by the study. They can provide valuable help to government, political and mining sector policy decision makers to visualise time-dependent causal interrelationships between networks of interconnected interests, desires, wishes and demands of stakeholders. It can allow such stakeholders to recognise and hence, take the right steps to protect against the future by doing the right things the right way today.

Separately, the supply chain analysis (SCA) clearly suggests that there are numerous opportunities through backwards and forward linkages that, if strengthened, could appreciably benefit not only Ghana, in general, but also the multinational gold mining companies and support services in Ghana. Mapping the supply and value chains, to encompass previously unconsidered or potential contributors to the supply chain, identifying tiers of local suppliers of specific items consumed by the industry is key to developing Ghana’s capability and capacity to contribute and benefit more from the sector, now and in the future.

⁴⁰ <https://www.tocforeducation.com/>; <https://www.tocico.org/>; <https://www.goldrattgroup.com/>; <https://www.tocpractice.com>

More importantly, the collective benefits for, and success of, all Ghanaian stakeholders of the gold mining industry is paramount. It is important to recognise that every stakeholder, including the Galamsey operators, mining communities, licensed gold buyers, mining companies and local suppliers (indigenous Ghanaian owned business and foreign owned businesses in Ghana), women, and civil society, have a considerable role to play, to benefit from the operations of the gold mining industry. The ability to bring key stakeholders together, develop commitment and boost trust and cooperation for the collective good of all depends on the stakeholder management capability of the industry. The study supports a recommendation aligned with the need to improve the understanding of the high-level map of generic stakeholders for specific projects or events; to understand the stakes, interests of specific stakeholders; to understand the salience and dynamics of stakeholders; and be able to analyse the impact of the sector's activities for and from the perspective of specific stakeholders. And then to provide specific solutions that are tailored to the needs of specific stakeholders.

Finally, the study leads to a view that an effective educational system is critical for sustainable development. The best way to managing and sustaining benefits from the multi-framing approach is to equip present and future generations with the knowledge, skills and values required to make sound managerial decisions and effectively solve problems.

Thus the researcher endorses a view that the multi-framing approach be embraced, promoted and encouraged in the educational system (from basic to tertiary) to prepare tomorrow's managers with the expertise to be successful in a world that is increasingly more volatile, ambiguous, uncertain and complex (Bennett & Lemoine, 2014). A culture of multi-framing and the acceptance of complementary, and different perspectives, is particularly critical in the context of a New (United) Africa where numerous opportunities exist for Ghana to position itself to benefit from one of the world's largest (if not the largest) free trade area, now and in the future.

7.7 Critical reflection on findings and contribution of this thesis

This section reflects on the contributions of this study by summarising specific findings driven by the models developed, and data collected for the thesis in the context of multi-framing literature and gold mining industry in Ghana.

These contributions may also be viewed as theoretical, methodological and knowledge contributions, in as much as they add knowledge and understanding of the situational context, the nature of gold mining in Ghana, and also illustrate the use and utility of individual frames in both stand-alone and complementary mode.

7.7.1 Data-driven findings – from the field study and literature

A key contribution of this study relates to addressing a fundamental concern about desired outcomes for stakeholders. Insights gained from the study show a desire by multinational large-scale gold mining companies and government alike to minimise adverse impacts and maximise the sector's outcomes for stakeholders, including those at the community level. However, the study provisional GT instead resulted in unresolved dilemmas and paradoxes, failing to achieve desired

outcomes. The following provides key examples of specific findings from the data collected from the field study of this thesis.

7.7.1.1 Integration of compensation into the project approval process

There is adequate evidence of a community compensation scheme that is integrated into the project approval process. The scheme is systematically monitored and complied with by the industry (*Section 4.2.2.1, Chapter 4 – FL01*). Yet, other evidence from the field study reveals that the livelihood chain of mining communities is broken, an issue that is grey and hence, constitute a fundamental challenge for regulators to effectively address (*Section 4.2.2.2, Chapter 4 – NL03b*).

7.7.1.2 Ingrained commitment to SCR by multinational LSGM companies

Findings from the field study additionally point to an ingrained commitment to SCR by multinational large-scale gold mining companies (*Sections 4.2.2.3, Chapter 4 – FL02*). This claim is confirmed by an industry expert (*Section 4.2.2.4, Chapter 4 – IE01b*). Notwithstanding this commitment to CSR, multinational large-scale gold mining communities are exposed to operational risks and uncertainties in as much as they find it increasingly difficult to gain adequate support from mining communities. This is due particularly to the absence of a formal agreement (such as an MOU between mining companies and mining communities (*Section 4.2.2.5, Chapter 4 – CL01*)). Consequently, mining communities have resorted to using demonstrations (some violent) against the LSGM sector, which they have found to be quite effective for getting their demands/concerns addressed by both the government of Ghana and multinational large-scale gold companies alike.

7.7.1.3 Minimising environmental impact

To minimise the adverse environmental consequences of gold mining in Ghana, the field study revealed that government uses the ERSBA for tighter regulation. This has necessarily induced compliance and commitment to environmental standards, and has contributed to improving environmental pollution, including reducing acid rainfall in some mining communities such as Bogos and Prestea and a reduction in acid content in some edible fruits in other mining communities (*Section 4.2.1.1, Chapter 4 – NL03a*). It is noted for example that improvement in processing technology from ‘roasting’ ore (that in the past, made edible fruits like the infamous Obuasi orange to taste extremely sweet) to alternatives such like oxide plants/CIL has significantly minimised the risks that LSGM activities posed to the health of members of the Obuasi community and that of the Ghanaian society in general. Nevertheless, other data from the field study also suggests that the ERSBA may constitute part of the environmental problem facing the industry as it encourages LSGM mining companies to mine gold in forest reserves in Ghana (*Section 4.2.1.2, Chapter 4 – IE01a*).

7.7.1.4 Government’s intent to reserve ASSGM to benefit Ghanaians

- This study also found that government aims to reserve the ASSGM sector to encourage investment by local Ghanaian investors to ultimately drive down poverty

in Ghana. However, Government has overlooked the need to promote the use of collaborative approaches such as the “Tributer System” even though that was specified by mining laws in Ghana with the potential to facilitate LSGM-ASSGM (*Section 4.4.2.1, Chapter 4 – IE01d*). It is additionally noted that the Government provides neither the financial support nor technical support needed by Ghanaians who express a desire to operate a formal ASSGM in Ghana (*Section 4.4.2.4, Chapter 4 – CL04*). It instead encourages foreign investors through, for example, *Regulation 2 (clause 3) of the Minerals and Mining (Support Services) Regulation (L.I. 2174)*, to invest in ASSGM sector. This results in leakages of value from the ASSGM sector and gives rise to illegalities and exposure to other risks as follows: Most of these foreign investors connive with elite members of society (particularly, some influential politicians and privileged leaders of mining communities) to exploit maximum benefits from the sector to the detriment of the wider mining community members. This means that ASSGM sector not only benefits privileged minority groups in the Ghanaian society, but their activities also contribute to leakages of value to their foreign associates.

- The use of mechanised operating equipment and processing technologies to extract more gold by such illegal actors contributes to illicit mechanisation of the ASSGM sector and poses risks to key stakeholders, including the Government.
- The Government of Ghana is, for example, faced with a growing need to restore the quality of polluted water bodies and rehabilitate degraded lands linked to mechanised ASSGM, raising remediation cost.

It must be noted that Ghana’s remediation cost is not limited to the ASSGM sector as the excavation activities of the LSGM sector may also contribute to degradation. Hence, as one of the participants of this study suggests, the more Ghana’s revenues from gold mining increase, the more its environmental challenges (through degradation) increase.

This is due largely to the LSGM sector’s reliance on technology solution to environmental challenges and the unfortunate absence of a technological solution to degradation through pit excavation by the LSGM sector (*Section 4.2.1.1 in Chapter 4 – NL03*).

- Also, closely associated with the artisanal gold market in Ghana is the more rudimentary form of ASSGM (often termed the Galamsey), involving the use of artisanal tools and artisanal processing technologies. The basic nature of such processing technologies used by the sector allows for extraction of only a significant minority of (an estimated 30%) gold from the gold ore. This leaves about 70% as of unextracted gold as ‘waste’ from the sector (*Section 4.4.2.3, Chapter 4 – CL02*). This study found that most rudimentary ASSGM operations are often sponsored by persons who are licensed to buy gold from the sector.

- To maximise their benefits, these licensed gold buyers illegally engage in the business of selling the gold to foreign buyers for cash thereby leaking out value. (*Section 4.3.2.4, Chapter 4 - CL03*).
- In addition to buying the gold, these licensed gold buyers also benefit from the 70% of waste materials from the rudimentary Galamsey sector, selling such materials to some mining companies (including LSGM companies).

Previous analyses of the artisanal mining sector in Ghana often refer to a formal and informal ASSGM sector (Bansah, Dumakor-Dupey, Kansake, Assan, & Bekui, 2018; Hilson, 2017; Teschner, 2012) . However, this study's data found little evidence for the existence of a formal ASSGM sector in Ghana. Hence, we may more appropriately refer to Ghana having an ostensibly formal ASSGM at best. Also, this study finds the artisanal gold market as in integral part of the ASSGM continuum in Ghana. However, despite the important role it plays in linking ASSGM miners to the global supply chain of gold, little attention is paid to the artisanal gold market sector in Ghana by contextual studies, constituting another surprising finding from this study.

7.7.1.5 Attraction of foreign investors to boost Ghana's potential of mining sector

The field study shows, for example, that Government aims to attract foreign investors to boost development of the LSGM sector to maximise Ghana's benefits. However, Government does not provide adequate supportive/attractive business environment for FDI. Instead, it uses aggressive strategies, including legislating for a 15% VAT on exploration activities in addition to using ring-fencing fiscal policy (*Section 4.3.3.1, Chapter 4 – FL05*) as well as providing tighter regulatory environment through the ERSBA. According to the field study, the use of such policies as VAT on exploration is constraining the ability of some mining companies in the LSGM sector to realise economic goals. To manage the risks, the LSGM sector justifies the ineffective approach such as laying-off staff as a business imperative, arguing it allows for the business to survive during lean seasons of the industry (*Section 4.2.2.3.1, Chapter 4 – FL03*). It also revealed that, some companies manage the risks by justifying tax avoidance behaviours such as failing to declare profits so they can avoid paying more taxes due the government (*Section 4.3.3.2, Chapter 4 – NL05*).

7.7.2 Findings driven by the analytical modelling approach

As discussed above, several factors were identified by this study as being responsible for the inability of mining sector policy decision makers and industry executives to maximise outcomes for Ghanaian stakeholders of the gold mining industry in Ghana This section is sub-divided to reflect on specific findings from the models developed for this study and findings from the multi-framing approach. These are considered below.

7.7.2.1 Specific findings driven by the models developed for this thesis

A key finding from the SA frame reflects the nature of relationships amongst stakeholders of the industry being characterised as arms-length /win-lose relationships, a finding that has implications impacting the capability of decision makers to resolve conflict. Complementing this, that CLD

modelling approach attributed the sector's problems to a focus on short-term goals. Confirming these findings, an EC frame attributed the problem to a limited understanding of how to deliver desired outcomes for stakeholders without compromise, and offered alternative actions/solutions for consideration. Additionally, findings from a CRT frame attributed the core problem limiting desirable outcomes for stakeholder of the industry to lack of collective effort amongst Ghanaian stakeholders of the industry, further complementing the findings from the SA, CLD and EC frames highlighted above. Relatedly, key findings from a supply chain analysis frame attributed the core problems limiting outcomes for Ghanaian stakeholders of the industry to leakages of value and offered different conceptualisations of such leakages. As illustrated in Figure 5.7 these include leakages through the artisanal gold market (through formal and informal means), leakages through the export of raw material gold and leakages through outsourcing of consultancy services, such as management of the MIIF, to foreign companies. It also includes leakages through mine support services provision by foreign investors and leakages through mechanised Galamsey activities, leakages through direct unconstrained FDI-FDI transactions/takeovers, leakages through hedging arrangements.

7.7.2.2 Findings contributing to the multi-framing literature

Specific findings driven by the multi-framing approach of this study can be summarised under five key points. These include multi-framing as an iterative process, the complementary, confirmatory nature of multi-framing, the impact of using one frame to inform use of another frame, and finally, the degree of compartmentalisation of the frames. Each of these points are further elaborated on as follows.

7.7.2.2.1 Multi-framing as an iterative process

This study's approach, grounded in soft OR/MS and involving a process of iterating back and forth between frames, is the first published study to demonstrate the practicality of using multiple systems-based frames in the context of an entire industry. Previous applications of multi-framing for complex decision making and problem solving are limited to other professional contexts such as military operations (Zweibelson et al., 2013), the justice/criminal system (Tallant & Strachan, 1995) and in the context addressing an ethical dilemma about whether or not to bid for a consultancy project to be used to inform public policy (Mabin & Davies, 2004). Additionally, previous studies of multi-framing have mainly used the approach to demonstrate the value of switching between different metaphors (Bolman & Deal, 2017) and the value of using different frames based on a sequential process (Davies & Mabin, 2001b). This study extends the utility of multi-framing for decision making and problem solving about complexity, uncertainty and conflict to the gold mining industry and underscores the value of systems-based frames, and the value of an iterative multi-framing process.

7.7.2.2.2 Complementary value of frames

Multi-framing allowed for insights from use of one frame to inform use another, corroborating prior studies about the complementary nature of frames (Mabin & Davies, 2003; Mabin et al., 2006). For example, the supply chain analysis frame informed stakeholder analysis and led to the

imperative of thinking about stakeholders from end-to-end of the gold supply chain, for a global perspective understanding.

7.7.2.2.3 Confirmatory value of frames

Multi-framing additionally served a confirmatory value in this study with insights from one frame confirming insights from another frame. For example, according to a CRT analysis, the root cause of problems limiting desired outcomes for stakeholders of the industry relates to the industry's lack of collective and coherent action. This lack of collective action of stakeholders aligns with a finding from the SA analysis regarding arms-length relationships amongst stakeholders, which has implications for the lack of capability amongst decision makers of the industry to resolve conflicts limiting desirable outcomes for stakeholders of the sector. Such insights then validated the need for a platform to develop awareness about conflicts and their solution, addressed through the use of the EC frame.

7.7.2.2.4 Use of one frame impacts use of another frame

The use of one frame impacted the use of another frame. For example, a stakeholder analysis impacted the supply chain analysis by allowing it to focus on how value is created and distributed amongst key stakeholders across the chain. Such an analysis impacted the findings and recommendations of this study regarding what needs to change about the gold mining industry in Ghana to maximise outcomes for the Ghanaian stakeholders of the industry.

7.7.2.2.5 Degree of distinctiveness, complementarity of frames

There is a degree of distinctiveness and complementarity associated with the use of frames. For example, even used as a stand-alone frame, a SA can provide distinct perspectives for the rational, process, transactional, capability management and dynamic levels of analyses, each dealing with specific issue of relevance, yet contributing in complementary fashion towards a bigger picture understanding from a stakeholder management perspective.

Similarly, within a TOC analytical domain, distinct frames can be distinguished according to: the underpinning logic (sufficiency-based versus necessity-based); by function performed (problem-focus such as CRT versus solution-focus (such as an EC and PRT); or by focus, such as a GT for determining the desired future, CRT for identification of root cause limiting achievement of the desired future limiting the desired future, and PRT for planning the road map of implementation of needed changes towards the desired future.

The same can be said for CLM which draws on behaviour-over-time charts for comparative analysis of two or more variables; CLDs for understanding cause-effect relationships between variables; and systems archetypes which act as reference frames for recognising familiar patterns. In addition, a SCA can be separated into specific activities/linkages from sourcing production, distribution, returns/reverse logistics, transportation, and warehousing/inventory management activities involved until an end consumer is reached.

As indicated, such distinctive and complementary features also exist when frames are used in a multi-framing fashion. It could be noted for example that, although no single frame is superior or designed to capture the full complexity of an entire sector, some frames are more suited than others

to contexts. SA, SCA, CLM and TOC frames are all driven by a systems view. However, in the context of examining cause-effect relationships, CLM and TOC can be more relevant. Also, a CLM frame, using CLD and systems archetypes, can be considered more relevant than TOC frames in the context of understanding cause-effect relationships and structuring problem situations without constraining the analysis to a problem focus. However, in the context of understanding the logic of cause-effect relationships and exposing implicit assumptions that impact systems performance and achievement of systems goals, a TOC frame becomes more powerful than a CLM.

7.7.2.2.6 Utility of multi-framing

Another key finding relates to utility of the multi-framing, and this can be considered in part, with reference to what participants think about the data collection approach which required them to contribute to provisional model(s) based on their own understanding of issues. It is noted that participants felt encouraged to talk about issues although company specific information was not required (see section 3.5.4.1 in Chapter 3). Multi-framing served as a useful conduit for stakeholders' views of the gold mining industry to be included in the models. By using multiple frames, participants could talk freely about any issues and data could be incorporated into whatever model(s) are appropriate.

In addition, the iterative manner in which the frames are used to inform each other's use and insights, rather than just be used to provide discrete perspectives and insights, and then the seeming organic nature in which insights emerged (see Figure 6.7) extends the utility and relevance of multi-framing. As such, this study echoes the findings of others Kokk, Jönsson, and Rovio-Johansson (2012); Clegg, Kornberger, and Pitsis (2011) about the usefulness of multi-framing towards practice theory of management. In their words, "the art of managing is the art of framing" (Clegg et al., 2011).

Multi-framing could additionally be used as a framework for multidisciplinary research and practice. Eden et al. (2009) allude to the long-standing theoretical debate around incommensurability in multimethodology research (Jackson, 1999; Mingers & Gill, 1997), placing a fundamental limitation on the multimethodology approach for dealing with real-world problems. This theoretical debate, according to Eden et al. (2009), has stymied development/progress of the field and hence, needs a more practical solution that can help to be addresses and advance the field.

The multi-framing approach used in this study could also contribute to a practical solution to the longstanding theoretical debate in the context of multimethodology literature, namely: paradigm incommensurability. Each frame is used separately and governed by its own protocols, and the aim was not to create an integrated model wherein paradigms might clash, providing a way forward for modelling in the multimethodology context.

7.8 Limitations

Despite the novelty of the theoretical, methodological and knowledge contributions and the practical utility of the multi-framing approach enacted in this study, there are naturally several limitations.

Whilst the researcher has background and professional experiences in the mining industry in Ghana and the West African sub-region, his experience and expertise was limited to the domain of supply chains. He continues to develop expertise with regard to the main problem-solving tools used in the study, particularly the TOC and CLM tools and methods which he was first exposed to in 2017 during his doctoral study with the Victoria University of Wellington – New Zealand. The technical aspects of modelling were mitigated through further study and the use of appropriate proprietary software – for example, *Flying Logic* (<http://flyinglogic.com/>) for the logic trees (TPs) and *Vensim* (<https://www.vensim.com/>) for the CLDs.

The study also experienced difficulties in conducting field research, securing participant interviews, due to their busy schedules and sometimes a reluctance due to the fear of the *Anas Aremeyaw Anas* factor (outlined in section 3.3.5) – matters that consequently led to the addition of interviews at industry conferences for data collection.

Such issues thus constitute limitations of this study. They resulted, for instance, in the use of only the provisional CRT frame for data collection and model/frame feedback, contrary to the original plan which aimed at getting participants to critique and validate a range of provisional models/frames developed for the study. As a consequence, the resulting analyses are based on data collection which could be considered partial in relation to initial intent – the analyses reflecting the researcher’s synthesis based on the literature and reflecting the discussions with participants from the field study, but without the range of detailed critique from those with deep knowledge of the sector that had been planned.

Indeed, model validation and data analysis coincided with the NZ lockdown period following the outbreak of Covid-19. This made it difficult for the logic diagrams/models to be discussed with field study participants’ organisations to the depth that had been anticipated and desired. Regarding the development of the generic EC for example, the researcher was denied opportunities to consider alternative conceptualisations such as a nested EC after contemplating that the EC could have been enhanced by complementing the 3-clouds approach with the former. This was however not possible within the limited time frame. Hence attention focused on the 3-cloud approach, the development of a high-level generic EC within which other individual ECs may be subsumed, and which generic EC provided a basis for ‘final’ CRT.

A second limitation of this study relates to its *deviation from the originating logic of multi-framing*. The original intention was to apply multi-framing in a logical sequence consistent with the prior work of Davies and Mabin (2001b). However, due to the lengthy and iterative nature of the research process, it proved to be impossible to resist moving between frames: for example, transferring relevant insights between the supply chain frame and stakeholder analysis frame after

spotting opportunities to improve one with insights gained from the other, and thus ultimately to allow a more complete analysis. This process, involving both sequence and iteration, continued throughout the study as opportunities for interplay between frames were realised and deviations made from a prior systematic sequence. Thus, multi-framing in the context of this study resulted from organic relationships that characterised the complementarity and differences of the various analytical frames.

These matters raise a third related and nuanced limitation concerning the cross-fertilised nature of the emergent multi-framing approach. This was also due to the lengthy nature of a PhD research project – in a quicker study it would have been more likely to apply each frame in sequence with less opportunity for cross-fertilisation, if this had been considered desirable. Thus, although cross-fertilisation served a useful purpose to validate findings from one frame with confirmation from another, it may raise concerns that the seemingly complex nature of the resulting framework may discourage others from attempting an approach that was more organic than had been previously documented. This could also create potential methodological challenge in terms of replicating the study, in which case, the research objective to establish a platform for multi-framing may be threatened.

Additionally, since the study topic was so wide-ranging in terms of scope of the entire gold mining sector, and the number of frames used, the depth of analysis possible for each frame or domain within the sector is obviously limited within the time and word limits of a PhD thesis. Added to this, the range and number of participants interviewed and the distances travelled to interview them made for time consuming field study and analysis. While the researcher decided on the study due to his interests and background, the purpose of the research was to explore the merits of multi-framing. This has necessitated spreading effort across all the different elements. Amidst these constraints, the researcher felt the need to cover the essential concepts to meet the needs of the industry and government to help them recognise core issues and see opportunities available to capitalise on them. Thus depending on background, some readers may consider some sections under-investigated and other parts over-explained. This leaves scope for future researchers to meet their particular interests, with this study providing a platform for such further research. Indeed, the researcher has already identified several conflicts that need to be addressed but could not be analysed due to time and word constraints. These are listed for further research.

The glaring imbalance between the number of male and female participants of the study is also a concern. This was not deliberate but arose due to participants being sought by positions and roles during the field study. Whilst such gender imbalance reflects the nature of the industry as “seemingly” male dominated sector, the researcher is of the view that the productive capacity of women is on the line and so are their fundamental human rights. However, the researcher could not deal with this, nor the related issues involving vulnerable stakeholders that were revealed through the stakeholder analysis (particularly the issue of protection for the rights and interest of children in mining communities and the right and interest of people living with disability in Ghana). Again, these issues are also noted for future research.

Finally, and indeed one that was expected, this study and its findings are limited to the context of the case study: gold mining in Ghana. Generalisation of such findings was not expected and cannot be made to other sectors. Thus while it is hoped that the approach has merit more widely, application to other sectors would require further research.

Acknowledging that the above limitations in nature and scope - and necessary in the context of this doctoral study - may have impacted the study and its findings in ways foreseen and unforeseen, topics ripe for future research are set out below.

7.9 Future research

Findings from this multi-framing, multi-level exploration of the gold mining industry in Ghana reveal several opportunities for further research. These include the opportunity for an industry-wide application of multi-framing to extend the practical utility of the multi-framing approach to other key economic sectors of the Ghanaian economy beyond the mineral resources and extractive sectors. The researcher anticipates that these sectors may share similarities with the gold mining industry in terms of what constitute the fundamental problems limiting desirable outcomes for stakeholders. By so doing the findings of this study may be found to have broader implications and relevance.

For example, additional opportunity exists for a multi-framing exploration of the sustainability challenges faced by the agricultural and food processing sectors, the clothing/garment industry, and the tourism sector in Ghana; and then what may need to change, what to change to, and how to cause the change towards the desired future.

The researcher also notes from the literature that maximising benefits from resource endowments - in this case, via gold mining - is a complex endeavour, involving the need to integrate relevant issues at the macro, micro and the supply chain levels. There is no single framework that is designed to manage the complexity of issues involved in addressing obstacles and maximising benefits for stakeholders of the industry without compromises.

A multi-framing decision-making framework that can guide stakeholders (particularly, government and mining companies alike) to manage the alignment between the strategy/targets and the supply chain strategy of these actors is required.

Such a framework should necessarily involve a global performance measure to ensure that governments of resource-endowed economies, mining companies and other stakeholders can maximise desired outcomes from the industry without compromises.

Also, the framework should necessarily include the two main perspectives for maximising the potential from resource wealth evident in literature, namely: maximum value (through strengthening of linkages) and revenue maximisation/sustainability (via establishment of sovereign wealth funds). Additionally, with the rollout and expansion of the African Continental Free Trade Area (AfCFTA), opportunity is ripe for cross-cultural collaboration between Ghana and its sister African countries that could lead to self-reinforcing win-win/non-zero-sum outcomes.

A multi-framing study of cross-cultural and diversity matters could then identify otherwise unrealised opportunities for collaboration and lead to a better understanding of how Ghana can become more adept at managing its relationships to become more successful in a culturally diverse African context where opportunities are believed to abound but are not yet recognised or realised.

Additional opportunities exist for research to investigate a range of issues (outlined in Table 6.5) as fundamental conflicts that require further analysis. Whilst these conflict situations could be analysed independently using the EC tool, each could form part of broader multi-framing study, particularly, longitudinal action-oriented research.

At the sector level, there is a dearth of studies of the mining industry grounded in systems thinking (ST), supply chain/value chain analysis (SC/VCA) and stakeholder analysis (SA), or in theory of constraints (TOC) management.

There is a need for more beneficial research in each of the identified domains, both at the industry and firm levels. Key questions relate to: (1) how supply chain managers understand the notions of supply chain and value chain and how this can learn from the notion of supply chains promoted by this study; (2) how managers understand the nature and scope of their managerial work and how they may be supported to succeed in their roles; (3) how project managers understand their role in the broader stakeholder context and how they may be assisted to improve their stakeholder management capability; and (4), how recognising and realising the value of the multi-framing approach impacts on managerial and overall business goal(s).

The researcher also sees possibilities in the following: a multi-framing analysis of cause(s) and solution(s) to child poverty in the context of Ghana, West Africa and Africa as whole; a multi-framing analysis of constraints to women's productive capacity improvement in Ghana in general and specifically, in the context of the extractive sector and how to overcome them; a multi-framing analysis for designing the future for an inclusive development of the productive capacity of people with disability in Ghana.

7.10 Summary of contributions of this thesis

The study makes a practical contribution by providing fresh insights and perspectives about the core problems limiting desirable outcomes for stakeholders of the gold mining industry in Ghana that have added to prior understanding of the sector.

Additional contributions are made through the showcasing of frameworks and tools that build awareness amongst government, political and mining sector policy decision makers, managers, industry executives and other interested stakeholders of alternative problem identification, problem solving and decision-making frameworks. In particular, such frameworks/frames constitute a platform to make sound decisions and address endogenous and exogenous cause-effect relationships that may otherwise limit desirable outcomes from actions taken.

In addition to analysis of the current situation, they provide suggested solutions and a roadmap for implementation. Such contributions can provide a platform for sound decision making and

problem solving about the industry and other key sectors to extend the practical utility of multi-framing to the Ghanaian economy.

Theoretical and knowledge-based contributions are made by conceptualising and offering evidence for three key factors or dimensions that can explain a significant number of behaviours, conditions and issues limiting desirable outcomes for stakeholders of the gold mining industry in Ghana. These include the difficulty of transitioning from theory (espoused aims) to practice; a relative focus on local optima (silo thinking); lack of a culture continuous improvement (End-of-the-road-syndrome). The study also collated information about previous studies (mostly involving single lenses with a few exceptions) in one place for the first time and built on these.

The systematic compilation of previous studies constitutes a theoretical contribution, whilst the collation of such information together with rich data from the field, in one place, contributes to practical knowledge.

The provision of a different conceptualisation of leakages additionally makes a theoretical contribution, as does the conceptualisation of the structure of ASSGM sector as a continuum of mining activities ranging from rudimentary ASSGM (informal), then mechanised ASSGM (informal), (ostensibly-formal) ASSGM, through the artisanal gold market (formal), to LSGM sector.

Beyond the theoretical contributions they make, these conceptualisations are practically relevant, providing a framework for better understanding the nature and structure of the industry for informed decisions and actions towards formalisation and avoidance of leakages from the industry.

Methodological contributions are made by demonstrating the application of a sequenced multi-framing approach, working down and across layers of various systemic levels of an industry (in this case, the gold mining industry in Ghana). Indeed, the value of multi-framing as a sequential approach is well known, including helping to generate complementary insights, and overcoming methodological blindness of single frames and fostering effective decision making / problem solving in the face of complexity (Davies & Mabin, 2001b; Mabin & Davies, 2004).

Additionally, the self-validating nature and value of organic multi-framing with cross-fertilisation, and the emergent multi-framing framework of this study, builds on and extends the methodological value of multi-framing and stimulates further research in the field. Finally, the retention of negative effects in the FRT as a reminder to stakeholders of obstacles that must be overcome in order to avoid the tendency of the checklist approach, also constitutes a methodological contribution.

7.11 Concluding remarks/statement

Where there is much desire to learn, there of necessity will be much arguing, much writing, many opinions; for opinion in good men (sic) is but knowledge in the making – John Milton (1608-1674) quoted in (De Wit & Meyer, 2010)

This study has used a multi-framing approach involving complementary systems thinking (ST) perspectives to understanding the nature, structure and relationships that make up the gold mining industry in Ghana. These systems perspectives include stakeholder analysis (SA), supply/value chain analysis (SC/VCA), causal loop modelling (CLM) and TOC analyses. In addition to offering complementary insights, multi-framing served a confirmatory function in this study. In most instances, the problems and insights surfaced from one frame directly (and indirectly) complemented and/or validated the insights from another frame, thereby enhancing the validity of, not only the insights and findings, but also the reliability and validity of the particular frames in use. Multi-framing thus, helped to narrow down the core problems limiting outcomes for stakeholders of the gold mining industry to three main factors as listed below.

Firstly, the prevalence of win-lose/zero sum situations and relationships adversely impact collective effort amongst stakeholders. Secondly, and relatedly, there is a lack of understanding of how to deliver desired outcomes for stakeholders without dysfunctional compromise. Thirdly, the industry has focused on short-term instead of long-term solutions to key issues limiting desirable outcomes for stakeholders. These factors are consistent with notions that emerged from the field study as key challenges facing the industry, namely a difficulty to transition from theory/knowledge to practice, a focus on local optima and the mission-accomplished (end-of-the-road) syndrome. This syndrome refers to a lack of an effective continuous improvement culture. It can be overcome by adopting the recommendations of this study and embracing a multi-framing approach, particularly the emergent, organic approach evolving in this study.

The study has achieved its overall purpose to provide government, political and mining sector policy decision makers, and other interested actors, with a platform for understanding the sector in order to support their decision making about the industry and potentially improve outcomes for key stakeholders.

The study makes important recommendations which can be framed using the Change Questions, namely: why change, what to change, what to change to, how to cause the change, and how to measure and sustain the change.

In relation to why there is a need for change, the researcher has drawn from the Goal Tree (GT) to suggest that the industry's critical success factors and necessary conditions, needed to improve outcomes for Ghanaian stakeholders, are not being achieved. In terms of what to change, the final Current Reality Tree (CRT) identifies the lack of collective efforts and the prevalence of win-lose relationships amongst stakeholders as aspects that need critical attention. They are essentially two sides of the same coin.

With reference to what to change to, a range of issues have been identified through the various analytical tools and refined using the Evaporating Cloud (EC) process to arrive at a conclusion. The EC frame suggests that the industry needs to change from the win-lose approach highlighted by the CRT to a more collaborative self-sustaining win-win approach, by seeking to address underlying conflicts that limit desirable outcomes. The EC frame additionally suggests, in agreement with the supply chain analysis (SCA) frame, the CLD and SA approaches, that the industry would benefit from change by promoting the collective good of all stakeholders. It is also important to note the possibility and benefits of resolving seemingly impossible conflicts/dilemmas via EC – whether it is an internal dilemma or external conflict or whether it is a do or don't do dilemma or conflict between opposing actions. Even apparently conflicting actions can be resolved without compromises, using (for example) Darrell Mann's Principles of separation (Stratton & Mann, 2003). Peter Senge's concept of systems archetypes (Senge, 1990) is equally important in this regard.

Building on the EC frame perspective and process, the PRT is used to outline plans to implement change to raise outcomes for Ghanaian stakeholders of the gold mining industry (including multinational mining companies and foreign owned businesses based in Ghana), now and in the future. The PRT was also used to outline plans to implement change at another level, to transition from focusing on predominantly commodity exports to focusing on local consumption and the further development of a value-added production economy for gold in Ghana.

The PRT has been particularly valuable (and necessary) given the researcher's recognition and awareness of the busy schedules of key actors of the industry such as policy decision makers, managers and industry executives. This paired with another key limitation of the industry (reflected as *difficulty of the industry to transition from knowledge to practice*) and coupled with the ambitious nature of the recommended changes, can make effective implementation of the required change difficult if not seemingly impossible. Hence, the need for the PRT – to identify obstacles, and intermediate objectives that must be fulfilled to overcome those obstacles - to ensure successful implementation and transition to the desired future.

With reference to sustaining the change, the researcher has made a range of recommendations directed towards embracing a culture of continuous improvement. However, it must be emphasised that whilst a range of continuous improvement methods and frameworks are available, not all focus clearly on wider systems goals. Appropriate continuous improvement methods in the context of this study refers to *systems-based perspectives* such as TOC which provides the right tools for focused improvement in a process of ongoing improvement.

The study recommends the TOC methodology as a suitable and practical approach to problem identification and problem solving, in general, and decision making about what needs to change, what to change to, how to cause change, and how to measure and sustain the change, in particular. It recommends the need to solidify the benefit from multi-framing by recognising and embracing the approach in the educational systems in Ghana. This has the potential to equip present and future

generations with the knowledge, skills and values required to make sound political and managerial decisions and effectively solve problems to step Ghana forward.

Finally, it is hoped that other scholars will appreciate the rationale for and utility of the multi-framing approach, and share findings from their own efforts, thereby advancing the field. Others may offer alternative approaches; such viewpoints constitute 'knowledge in the making.' Together, further studies of the sector will contribute to advancing knowledge about the Ghanaian gold mining industry, thereby promoting the purpose and objectives of this study.

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Appendix 1: Provisional CRT of gold mining industry in Ghana

Appendix 2: The categories of legitimate reservation (CLR)

<i>Scrutinising Trees with others knowledgeable in CLR</i>	<i>In conversation</i>
I have a CLARITY reservation on...(specify)	I'm not sure I understand. Could you CLARIFY what you mean by (Specify)?
I have an ENTITY EXISTENCE reservation on...(specify)	Maybe I still don't understand. How do we know that (specify) EXISTS? What evidence is there to support it?
I have a CASUALITY EXISTENCE reservation on the connection between...(specify)	I'm not sure I see how (CAUSE) leads to (EFFECT). Could you please explain it to me?
I have a CAUSE INSUFFICIENCY reservation for (specify EFFECT), and I think the missing element is (specify)	It seems to me there is something missing. Besides (specify CAUSE), you'd need (provide contributing CAUSE) to get (EFFECT)
I have a CAUSE-EFFECT REVERSAL reservation. It looks like (specify CAUSE) is really the effect, and vice-versa.	I think you definitely have a connection there, but could (specify CAUSE) really be the effect? And (specify EFFECT) really be the cause?
I have an ADDITIONAL CAUSE reservation about (specify EFFECT), and the additional cause is (specify independent CAUSE)	What you have there looks good. But could there be something completely separate that could give the same effect? I'm thinking of (specify ADDITIONAL CAUSE)
I have a PREDICTED EFFECT EXISTENCE reservation. If (CAUSE) really leads to (EFFECT) then we should also see (or not see) (specify PREDICTED EFFECT). But we do not (or do).	The cause you are proposing is a little hard to verify. It seems to me that if what you say is true, we should also see (PREDICTED EFFECT). But as far as I know it's not there.
I have a TAUTOLOGY RESERVATION about (specify CAUSE & EFFECT). The absence or presence of (specify EFFECT) doesn't confirm (specify CAUSE)	Wait a minute. Are you saying that (EFFECT) is the justification that (CAUSE) exists? That sounds like circular logic. Perhaps you can explain it to me.

Translating reservations into conversational English
Source: Goldratt's Theory of Constraints, Dettmer. H., 1997, P.339

Appendix 3: Recruitment email/HEC FORMS

Understanding the nature, structure and relationships that make up the gold mining industry in Ghana: A multi-framing, multi-level exploration

RECRUITMENT EMAIL

Victoria University of Wellington School of Management

Date.....

Dear [.....],

I am a PhD candidate in the school of management (faculty of commerce & Administration) at Victoria University of Wellington, New Zealand. My study explores the gold mining industry in Ghana using a multi-framing, multi-level approach.

The main objective is to understand the nature, structure and relationships that make up the gold mining industry in Ghana with a view to providing government, mining policy decision makers, and key other stakeholders a platform to support their decision making about the sector. Specifically, the research will set out to meet this objective via the following 3 research sub-objectives:

1. Develop a comprehensive, multi-perspective description and understanding of the nature, structure and relationships that make up the gold mining industry in Ghana.
2. Identify root causes of significant problems facing the gold mining industry in Ghana and offer suggestions for possible alternatives that when implemented could help to overcome such problems.
3. Demonstrate the utility of complementary multiple systems thinking frameworks that can in due course provide government, political and mining sector policy decision makers with a better understanding of the sector in order to support their decision making strategically but also operationally, and tactically, where necessary.

I would appreciate your expert input to the study, and to this end, I would like to present one or more of these diagrams in a discussion and seek your feedback at a date/time and location that is convenient to you within the study period (from..... to..... 2019).

You would find further details about this study in discussant information sheet and discussant consent forms that are attached as separate documents in this email.

Thank you for your cooperation.

Edward Johnson

Understanding the nature, structure and relationships that make up the gold mining industry in Ghana: A multi-framing, multi-level exploration

INFORMATION SHEET FOR PARTICIPANTS

Thank you for your interest in this study. Please read this information before deciding whether or not to take part. If you decide to participate, thank you. Yet if you decide not to take part, thank you for considering my request.

This study is about understanding root causes of key problems facing the gold mining sector in Ghana and to use this understanding to then inform how the sector could be improved and sustained. The mining industry in general and gold mining in particular is important as it serves as a spring board for economic development of the country (through FDI and export potential). Studies of the industry to date have overlooked diverse viewpoints and used limited-scope, single-frame analyses. However they have highlighted wide-ranging industry issues that impact stakeholders of the sector, which could benefit from fuller analysis. This study shows how we can combine various tools/frameworks and views from key stakeholders to understand the sector a lot better than before.

To begin my investigation of this topic, I have prepared some temporary diagrams using various systems diagrams and information that is available publicly. I would appreciate your expert input to the study, and to this end, I would like to present one or more of these diagrams and seek your feedback. The study is thus, not intended to implicate/blame any stakeholder. Instead, it gives opportunity to key stakeholders to validate (or disapprove) assumptions pertaining to them directly or the industry in general.

The information you provide will lead to improved stakeholders' understanding about gold mining, and inform sound strategic, operational and tactical decision making towards the sustainable development of Ghana.

The researcher is an independent/PhD candidate from the School of Management (Faculty of Commerce) at Victoria University of Wellington (VUW). Please rest assured that your safety and security are paramount to the overall success of this study. The study has been vetted and approved by the VUW Human Ethics Committee (HEC). As such, any information/suggestions you contribute towards improving the temporary diagrams of this study will be treated as completely confidential and none of your views/feedbacks will be attributed to you (unless you wish otherwise).

To maintain confidentiality of feedbacks/comments/suggestions, the researcher will use generic terms/codes during the transcribing and write up phases. Feedback from a senior manager for example, of a large-scale gold mining firm will be recorded as (FL01) etc.

The results of this study will be presented in a thesis provisionally titled: “Understanding the nature, structure and relationships that make up the gold mining industry in Ghana – a multi-framing, multi-level exploration”. The results may also be presented in academic and professional journals/conferences, seminars, book chapters and industry reports.

Overall, the interview divided into two sessions, is expected to take about 1 hour to complete. The first session which is the presentation phase will be completed in 20 minutes. The second session is the feedback phase and is expected to last not more than 40 minutes. Here, I will invite you to contribute to this study by:

1. Identifying aspects of the diagrams that you agree with, or find appropriate
2. Identifying aspects of the diagrams that you have some questions about or need further clarifications
3. Identifying where important aspects are missing from the diagrams

The above sessions will be held at a location convenient to you and these will be audio recorded with your permission for transcribing purposes. The audio will be available **only** to my supervisors and myself, and will be **destroyed immediately after I have checked transcripts.**

Your rights as a participant

Whilst your participation will contribute significantly to the success of this study, you are not under any obligation to do so. In case you are willing/decide to participate, you can exercise any of the following right as a participant:

- choose not to answer any question;
- ask for audio recorder to be turned off at any time during the discussion
- withdraw from the study up to two (2) weeks after the discussion
- ask any question about the study at any time
- receive copy of transcript of your feedback
- read over and comment on a written summary of your feedback
- elect to receive an executive summary of findings from the study

Should you have any question regarding this study now or in the future, please feel free to contact:

Student: Edward Johnson, Edward.Johnson@VUW.ac.nz

Supervisors:

Professor Vicky Mabin, School of Management, Victoria Business School, Rutherford House, 23 Lambton Quay, Pipitea Campus, Victoria University of Wellington, P.O. Box 600, Wellington, 6140, New Zealand. Phone: +64 4 463 5140; Email: Vicky.Mabin@VUW.ac.nz

Emeritus Professor John Davies, School of Management, Victoria Business School, Rutherford House, 23 Lambton Quay, Pipitea Campus, Victoria University of Wellington, P.O. Box 600, Wellington, 6140, New Zealand. Phone: +64 4 463 5382, Email: John.Davies@VUW.ac.nz

If you have any concerns about the ethical conduct of the study, please feel free to contact the Victoria University of Wellington Human Ethics Committee (HEC) Convener:

Dr Judith Loveridge, email: hec@vuw.ac.nz, phone (04) 463 6028

Understanding the nature, structure and relationships that make up the gold mining industry in Ghana: A multi-framing, multi-level exploration

INTERVIEW PROMPTS

This study uses feedback from preliminary diagrams prepared using various systems diagramming methods and information available publicly as data input in addition to information that may be available from the database of participating organisations.

Overall, the interview, divided into two sessions, is expected to take about 1 hour to complete. The first session which is the presentation phase will be completed in 20 minutes. The second session is the feedback phase and will last for 40 minutes. Here, I will invite you to contribute to this study by:

1. Identifying aspects of the diagrams that you agree with, or find appropriate
2. Identifying aspects of the diagrams that you have some doubts about or need further explanations
3. Identifying where important aspects are missing from the diagrams

ILLUSTRATIVE PROMPTS

Prompts relating to aspects of the diagram that you “agree” with

- Do you think the overall objective captured in the diagram is appropriate?
- Does the diagram capture variables/entities that you consider important?
- Does the diagram capture relationships that you consider important?

Prompts relating to aspects of the diagram that you have “reservations” about:

- Do you have any doubts about whether the diagram is sufficiently complete?
- Do you have any doubts about the overall objective of the diagram or the way in which the objective is stated?
- Do you have any questions about the labelling/description of variables shown in the diagram?
- Do you have any doubts about the causal relationships shown in the diagram?
- Do you have doubts or concerns about the detail or complexity of the diagram?

Prompts relating to identifying “missing” aspects of the diagram:

- Do you think any important variables or entities are missing from the diagram?
- Do you think that important relationships are missing from the diagram?

Understanding the nature, structure and relationships that make up the gold mining industry in Ghana: A multi-framing, multi-level exploration

CONSENT TO INTERVIEW

Researcher: Edward Johnson, Victoria University of Wellington, New Zealand

(A) Declaration:

- I have read the information sheet and all my questions have been sufficiently answered. I therefore agree to participate in this study
- I also agree to take part in an audio recorded discussion where needed

(B) I understand that I may:

- choose not to answer any question during the discussion
- ask for audio recorder to be turned off at any time during the discussion
- withdraw from the study up to two (2) weeks after the discussion
- ask any question about the study at any time
- receive copy of transcript of feedback I provided to the researcher
- read over and comment on a written summary of feedback I provided to the researcher
- elect to receive an executive summary of findings from the study

(C) I also understand that:

- my responses are confidential and will not be attributable to me unless otherwise agreed to by me
- results from the study may be reported and published in a thesis, academic/professional journal/conferences and seminars, book chapters, and industry reports
- all the information collected during this discussion will be accessible by the researcher and his supervisors
- The researcher will discard the recording after checking the transcription.

(D) Please indicate your preference by choosing (yes) or (No) for each of the following:

- I would like to have a copy of transcript of my discussion to be sure it reflects my views
 - Yes
 - No
- I would like to receive executive summary of findings from the study
 - Yes
 - No

(E) Please provide email address if your preference is (yes) in any of the requests as specified in (D) above, otherwise jump to (F)

Email: _____

(F) Please sign by providing only your name and date below:

Name (Participant): _____, on (date):/...../20...

Witnessed by (Researcher): _____, on (date):/...../20...

Appendix 4: Provisional CRT into segments and questions

Introduction

Thank you for your interest to participate/support me in my quest to gaining a better understanding about the gold mining industry in Ghana. I will ask questions based on the provisional Current Reality Tree (CRT) I developed for the gold mining industry in Ghana which I have broken as follows for easy understanding.

A CRT is one of several thinking process tools from the domain of Theory of Constraints (TOC). It allows us to capture/show/describe linkages or relationships between a given cause and effect. Thus, in a CRT we postulate root causes (near the bottom) that we think are leading to the problematic symptoms or effects (sometimes undesirable) at the top of the diagram.

Note that the numbers in each of the figures presented below are just to keep track of the boxes in the CRT – they are not significant otherwise.

Figure 1.1 Overall UDE (Undesirable Effect):

The provisional CRT of gold mining industry in Ghana suggests that *Benefits for stakeholders (State, Communities & Investors) fall short of expectations.*

140. Benefits for stakeholders
(State, communities &
Investors) fall short of
expectations.

Question 1

- a) Do you think the overall UDE (undesirable effect) of the CRT (shown in Figure 1.1) is appropriate?
- b) Do you have any doubts about the way the overall UDE is captured above or the way in which it is stated?
- c) Do you think we should be more concerned about something else as the overall UDE of the sector other than what is captured above?

Figure 1.2 Cause-effect relationships leading to the overall UDE (*Benefits for stakeholders (State, Communities & Investors fall short of expectations*)

In the provisional CRT, I have identified 5 causes that appear to be causing 140 Benefits to (State, communities & Investors) fall short of the expectations as shown in Figure 1.2 above. The cause-effect relationships giving rise to the overall UDE are verbalised using (If-then) logic as follows:

- If** Ghana's economic potential of gold mining sector is not fulfilled, **then**, *Benefits for stakeholders (State, Communities & Investors) fall short of expectations*
- If** Employees of LSGM sector are faced with repeated episodes of redundancy, **then** *Benefits for stakeholders (State, Communities & Investors) fall short of expectations*
- If** Shareholder expectations are not met, **then**, *Benefits for stakeholders (State, Communities & Investors) fall short of expectations*
- If** social benefits of gold mining in Ghana is less than desired, **then**, *Benefits for stakeholders (State, Communities & Investors) fall short of expectations*
- If** Economic wellbeing of gold mining communities remain poor, **then**, *Benefits for stakeholders (State, Communities & Investors) fall short of expectations*
- If** Firm profit margin gets smaller (smaller) **then**, Shareholder expectations are not met

Question 2

Do you agree that each of these causes contributes to the UDE 140 on their own, or is it a combination of factors that causes 140 to occur?

- Do you have any doubt about whether the causes listed above are enough to give rise to the overall UDE Benefits for stakeholders (State, Communities & Investors) fall short of expectations?
- Or do you think any important variables or entities are missing that also contributes to the overall UDE of the sector?

Figure 1.3 Cause-effect relationships giving rise to the UDE 130 (*Ghana's economic potential of gold mining sector is not fulfilled*):

The cause-effect relationship evident in Figure 1.3 above is verbalised as follows:

- a) **If** Employees of LSGM sector are faced with repeated episodes of redundancy, **then** *Ghana's economic potential from gold mining is not fulfilled*
- b) **If** social benefit of gold mining is less than desired, **then** *Ghana's economic potential of gold mining sector is not fulfilled*
- c) **If** Ghana's environmental cost/consequences of gold mining is high, **then** *Ghana's economic potential of gold mining sector is not fulfilled*
- d) **If** Environmental degradation and pollution associated with gold mining in Ghana rises, **then** Ghana's environmental cost/consequences of gold mining is high

Questions 3

Do you agree that each of these causes contributes to the UDE 130 on their own, or is it a combination of factors that causes 130 to occur?

- a) Do you have any doubts about whether the causes giving rise to the UDE 130 (*Ghana's economic potential of gold mining sector is not fulfilled*) are sufficiently complete?
- b) Do you think any important variables or entities are missing that also contribute to the above UDE 130?

Figure 1.4 Cause-effect relationships giving rise to the UDE 110 (*Social benefit of gold mining is not realised relative to expectation*):

The cause-effect relationship shown in Figure 1.5 above is verbalised as follows:

- a) **If** Economic wellbeing of gold mining communities remain poor, **then** *Social benefits of gold mining is less than desired*
- b) **If** Gold mining adversely affects economic livelihoods in mining communities, **then** *Social benefits of gold mining is not realised relative to expectation*
- c) **If** Local consumption of gold is not prioritised, **then** *Social benefit of gold mining is not realised relative to expectation*
- d) **If** gold mining adversely affects economic livelihoods in mining communities, **and** value-adding activities are undertaken/benefit overseas firms, **then** Economic wellbeing of mining communities is poor (**Note:** The curved lines symbolises ‘and’)

Questions 4

Do you agree that each of these causes contributes to the UDE 110 on their own, or is it a combination of factors that causes 110 to occur?

- a) Do you have any doubts about whether the causes giving rise to the UDE 110 (*Social benefit of gold mining is not realised relative to expectation*) of the gold mining industry in Ghana are sufficiently complete?
- b) Do you think any important variables or entities are missing that also contribute to the above UDE of the sector?

Figure 1.5 Cause-effect relationships giving rise to the UDE 90 (*Environmental degradation and pollution associated with gold mining rises*):

The cause-effect relationship evident in Figure 1.4 above is verbalised as follows:

- a) **If** Gold mining involves use of unsafe production methods that endangers the environment, **then** *Environmental degradation and pollution associated with gold mining in Ghana rises*
- b) **If** ASSGM sector is under developed, **then** *Environmental degradation and pollution associated with gold mining in Ghana rises*
- c) **If** Most ASSGM are operated illegally, **then** *Environmental degradation and pollution associated with gold mining in Ghana rises*
- d) **If** ASSGM sector is mostly artisanal, **then** ASSGM sector is under developed
- e) **If** Illegal ASSGM is a practical alternative for poverty driven operators, **then** Most ASSG are operated illegally

Questions 5

Do you agree that each of these causes contributes to the UDE 90 on their own, or is it a combination of factors that causes 95 to occur?

- a) Do you have any doubts about whether the causes giving rise to the UDE 90 (*Environmental degradation and pollution associated with gold mining rises*) are sufficiently complete?
- b) Do you think any important variables or entities are missing that also contribute to the above UDE of the sector?

Figure 1.6 Cause-effect relationships giving rise to UDE 80 (*Value-adding activities are undertaken/benefit overseas firms*):

The cause-effect relationship shown in Figure 1.6 above is verbalised as follows:

- If Significant amount of raw/semi-refined gold is exported, **and** Local consumption of gold is not prioritised, **then** *Value-adding activities are undertaken/benefit overseas firms* (**Note:** The curved lines symbolises ‘and’)
- If** Capability of local economic activities linked to gold mining value/supply chain is under developed, **then** *Value-adding activities are undertaken/benefit overseas firms*
- If** Government provides a facilitative regulatory environment for FDI sector in Ghana, **then** Significant amount of raw/semi-refined gold is exported
- If** Government prioritises development of LSGM sector in Ghana, **then** Government provides a facilitative regulatory environment for FDI sector in Ghana
- If** Government encourages FDI, **then** Government provides a facilitative regulatory environment for FDI sector in Ghana

Questions 6

Do you agree that each of these causes contributes to the UDE 80 on their own, or is it a combination of factors that causes 80 to occur?

- Do you have any doubts about whether the causes giving rise to the UDE 80 (*Value-adding activities are undertaken/benefit overseas firms*) are sufficiently complete?
- Do you think any important variables or entities are missing that also contribute to the above UDE of the sector?

Figure 1.7 Cause-effect relationships giving rise to UDE 104 (*LSGM sector struggles to achieve economic goals*):

The cause-effect relationship shown in Figure 1.7 above is verbalised as follows:

- a) **If** Operating costs increases, **and** Operational efficiency is not achieved **then** *LSGM sector struggles to achieve economic goals* (**Note:** The curved lines symbolises ‘and’)
- b) **If** Gold mining value/supply chain is not harnessed, **then** Operational efficiency is not achieved

Questions 7

Do you agree that each of these causes contributes to the UDE 104 on their own, or is it a combination of factors that causes 104 to occur?

- a) Do you have any doubts about whether the causes giving rise to the UDE 104 (*LSGM sector struggles to achieve economic goals*) are sufficiently complete?
- b) Do you think any important variables or entities are missing that also contribute to the above UDE of the sector?

Figure 1.8 Cause-effect relationships giving rise to UDE 56 (*Complexity of gold mining supply chain is not well-managed*):

The cause-effect relationship shown in Figure 1.8 above is verbalised as follows:

- If** Management attention is often wasted, **then** *Complexity of gold mining industry is not well-managed*
- If** LSGM sector engages in silo thinking, **and** Managers have too many decisions to make in time available, **then** *Complexity of gold mining industry is not well-managed*
- If** Managers have too many decisions to make in time available, **and** managers lose focus, **then** Management attention is often wasted (**Note:** The curved lines symbolises 'and')
- If** Managers have too many decisions to make in time available, **then** managers lose focus
- If** LSGM sector pursues functional objectives at firm/departmental level, **then** Managers have too many decisions to make in time available
- If** LSGM sector pursues functional objectives at firm/departmental level, **then** LSGM sector engages in silo thinking

Questions 8

Do you agree that each of these causes contributes to the UDE 56 on their own, or is it a combination of factors that causes 56 to occur?

- Do you have any doubts about whether the causes giving rise to the UDE 56 (*Complexity of gold mining industry is not well-managed*) are sufficiently complete?
- Do you think any important variables or entities are missing that also contribute to the above UDE of the sector?

Figure 1.9 Cause-effect relationships giving rise to UDE 39 (*Government encourages FDI*):

The cause-effect relationship shown in Figure 1.8 above is verbalised as follows:

- If** Government aims at boosting foreign exchange reserves, **and** Government seeks additional funds, **then** *Government encourages FDI*
- If** Government goal is to achieve economic development and poverty reduction in Ghana, **and** Government has limited funds **then** Government aims at boosting foreign exchange reserves
- Government goal is to achieve economic development and poverty reduction in Ghana, **and** Government has limited funds **then** Government seeks additional funds (**Note:** The curved lines symbolises 'and')

Questions 9

Do you agree that each of these causes contributes to the UDE 30 on their own, or is it a combination of factors that causes 30 to occur?

- Do you have any doubts about whether the causes giving rise to the UDE 30 (*Government encourages FDI*) are sufficiently complete?
- Do you think any important variables or entities are missing that also contribute to the above UDE of the sector?

Thank you

Appendix 5: Provisional stakeholder map

A provisional Stakeholder Map of the Gold Mining Industry in Ghana

Appendix 6: Provisional supply chain map

Appendix 7: Provisional CLD

Appendix 8: Provisional goal tree

Appendix 9: Final CRT of the gold mining industry in Ghana

Appendix 10: Implementation plan for PRT 1

Appendix 11: Implementation plan for PRT2

Appendix 12: Implementation plan for PRT 3