

Testing the Economic Strength of a Sustainable Base of the Pyramid

ABSTRACT

The mining industry has abundant leverage points as well as the potential to contribute to all the 17 United Nations Sustainable Development Goals (SDGs). To date, significant efforts have been made to mitigate the negative impacts of mining and enhance its positive contributions, especially by large scale mining (LSM) houses. Nonetheless, a lot remains to be done in mining areas where people at the base of the pyramid operate. These areas are exploited by Artisanal and Small-Scale Mining (ASM) actors who constitute 80% of the global mining workforce. The ASM industry is responsible for widespread negative environmental, social, and economic impacts. A lot of research has been done in ASM, but sustainable development remains far from being realized. In this study, we apply the institutional complexity lens to investigate forces impeding sustainability in this sector. Furthermore, we avoid applying any existing method of analysis and rather try synthesis as a methodological path in search for the missing knowledge. The results include identification of leverage points for sustainable development in fields where no large-scale mining houses exist; development of suitable business models; and a methodological contribution of holism to cases of institutional complexity.

Keywords: institutional complexity, institutional logics, artisanal and small-scale mining, base of the pyramid, sustainability, financial performance

INTRODUCTION

Decades of pursuit for prosperity has set the world on a trajectory of grave ecological challenges including climate change and biodiversity collapse. With regards to the latter, recent research shows that only 2 to 3% of the earth's land remains ecologically intact (Plumptre *et al.*, 2021). On the other hand, the climate crisis which is threatening life both on land and water continues unabated, and indications are that global temperatures will reach up to 3.2⁰C by the end of the century (Spencer, 2021). According to the SDG Report (2020), greenhouse gas emissions must fall by 7.6% every year from 2020 onwards to meet the 1.5⁰C or 2⁰C Paris Agreement temperature rise targets.

One way in which economies are responding to the climate crisis is by shifting away from fossil fuels towards cleaner energy sources. However, this shift calls for increased production of materials for solar panels, wind turbines, electric vehicles, fuel cells, batteries, hydrogen and more. Alongside this industrial material demand, the demand for gold, among other precious metals and precious stones remains high due to economic expansion, risk and uncertainty, opportunity cost and price momentum (World Gold Council, 2021). The result of all these developments is increased demand for minerals. These minerals come oftentimes from industries located in remote, less developed, ecologically sensitive and mainly indigenous areas (Columbia Center on Sustainable Investment, 2016). It is no coincidence that such areas are on an upward trend in generating greenhouse emissions as shown in Figure 1.

Insert Figure 1 about here

When effectively managed, the mining industry can bring about, inter alia, employment creation, innovation, and infrastructural development. More importantly, the industry can

assure sustainable livelihoods for people at the base of the pyramid (Prahalad & Hart, 2008). The ‘base of the pyramid’ is a term used by Prahalad and Hart (2008) referring to about 4 billion people with an annual per capita income of less than \$1500. Based on purchasing power parity in US dollars, this amount of money is the minimum necessary to sustain a decent life.

Despite the benefits that mining brings to the base of the pyramid, the industry has numerous negative environmental, social, and economic impacts. If poorly managed, mining can result in environmental degradation, worsening economic and social inequality, population displacement, armed conflicts, gender-based violence, corruption, tax evasion, increased health risks, land and water pollution and human rights violations (Columbia Center on Sustainable Investment, 2016; Hilson & Maconachie, 2020; Spiegel, 2015). Balancing these negative impacts with the positive contributions of mining has been the focus of sustainability research in mining over the past two decades.

Sustainability is achieved when material needs of a society are reconciled with appropriate exploitation of the society’s natural resources (Gowdy & McDaniel, 1999). Hilson & Murck (2000) note that the sustainable mineral exploitation theories in literature are not perfectly relevant to the sustainability of operating mines. This is demonstrated in cases where investors finance mines, with the knowledge that their projects will only function as long as the business continues to make economic sense. Mudd (2009) further elaborates that large mining companies, in a bid to appear sustainable, have adopted the habit of publishing sustainability reports annually, especially in respect to their adherence to environmental laws. Nonetheless, this is happening only in LSM, and is not present in ASM.

The ASM sector is a sub-category of the mining industry where sustainability is lagging. Many countries consider ASM as a combination of two categories namely artisanal mining and small-scale mining. Artisanal mining is informal, labor intensive and low tech while small-scale mining is formal but still low tech and labor intensive (Chakravorty, 2001). Millions of people from low-income economies, globally are involved in the exploitation of mineral resources in a substantially informal way in ASM (Hilson & Hilson, 2015). Some estimated 40 million people are directly involved in ASM in over 80 countries while an additional 120 to 280 million people benefit indirectly from ASM for their livelihoods (de Haan, 2021). ASM also contributes 15 to 20% of global minerals output (Buxton, 2013; Villegas *et al.*, 2012). Nonetheless, ASM has potential negative social and environmental impacts that are quite significant (Rustad *et al.*, 2016; Smith, 2019; Spiegel, 2012).

Past studies show that several approaches have been tried in a bid to make ASM sustainable (Fold *et al.*, 2014; Hilson *et al.*, 2018; Spiegel, 2012, 2015; Verbrugge & Besmanos, 2016). Most of these approaches follow a path that researchers call formalization. From a broader view, formalization is the registering, organizing and monitoring of mining operations in the field (Heemskerk, 2005). The various formalization approaches created by civil society groups, government and ASM actors resulted in the emergence of several, conflicting sets of guiding principles to ASM. These sets of guiding principles are described by institutional theorists as institutional logics (Friedland & Alford, 1991; Jackall, 1988; Thornton & Ocasio, 2012). When institutional logics multiply while simultaneously imposing divergent and incompatible prescriptions to organizations, they create institutional complexity which is often a challenge to organizations (Besharov & Smith, 2014; Greenwood *et al.*, 2011).

The effects of institutional complexity have previously been investigated, but mostly at a two-dimensional level. For example, Reay & Hinings (2009) investigated a competition between logics of ‘medical professionalism’ and ‘business-like health care’ in Canadian hospitals. Battilana & Dorado (2010) described how leaders of the Los Andes micro-finance organization hired members carrying neither of the required banking nor development logics, and socialized them into adherence with an integrated mission incorporating both logics. Smith *et al.* (2013) also showed how social enterprises combine logics of social welfare with market logics. On the backdrop of this limitation in past studies, Greenwood *et al.* (2011) posited that there is a special need for a fuller examination of settings in which more than two competing logics operate. The ASM industry exhibits at least four conflicting institutional logics, thereby creating an opportunity to fill this literature gap.

In this study, we do not investigate all the missing knowledge about institutional complexity in fields with more than two logics. Given that ASM is an industry existing at the base of the pyramid, we choose to focus on the effects of institutional complexity on financial performance. Additionally, given the need to advance sustainability in ASM, we explore how the pursuit for sustainability amidst institutional complexity affects financial performance. In sum, we ask the question, ‘How does pursuing sustainability outcomes in a field characterized by institutional complexity, such as ASM, affect the financial performance of involved actors?’

We applied a systems science methodology to investigate actor responses to multiple, competing logics in ASM. The results of our study indicate the possibility of an economically viable ASM sustainability agenda. The study shows where leverage points for both achieving sustainability outcomes and financial performance stand. The findings also display the

usefulness of systems science methodologies in enhancing our understanding of institutional complexity.

THEORETICAL FOUNDATION

Institutional Logics

Friedland and Alford (1991) use the term institutional logics to describe the interrelationships between individuals, organizations, and society. They define an institutional logic as a set of material practices and symbolic constructions that guide the institution (Friedland & Alford, 1991). A second, albeit related definition by Jackall (1988) succinctly defines an institutional logic as the way in which a particular social world operates. Thornton and Ocasio (1999) synthesize the two views and posit institutional logics as ‘socially constructed, historical patterns of material practices, values, assumptions, rules and beliefs by which individuals produce and reproduce their material subsistence, organize time and space, and provide meaning to social reality.’

Institutional logics are associated with societal-level institutional orders. Scholars identify these institutional orders in relation to family, religion, market, state, community, profession and corporation (Friedland & Alford, 1991; Thornton & Ocasio, 2012). A combination of these institutional logics makes up cornerstone societal institutions that govern shared areas of life. As a result, institutional logics provide societal actors such as organizations with the ‘rules of the game.’ Societal actors use these rules to categorize and infuse their activities with meaning and value (Greenwood *et al.*, 2019). In sum, institutional logics provide organizations and their members with organizing principles and means to ends designations (Friedland & Alford, 1991; Pache & Santos, 2013). By so doing, institutional logics offer prescriptions on “how to

interpret organizational reality, what constitutes appropriate practice, and how to succeed” (Thornton, 2004: 70).

Institutional complexity

Many organizations operate in institutional fields characterized by multiple logics. The prevalence of multiple logics that influence organizational practice creates a situation of institutional pluralism (Kraatz & Block, 2008; Pache & Santos, 2010). In one-way, institutional pluralism can offer consistent and compatible prescriptions that are easy for organizations to reconcile or blend (Thornton *et al.*, 2012). However, in some cases multiple logics impose divergent and incompatible prescriptions, thereby breeding institutional complexity before organizations (Besharov & Smith, 2014; Greenwood *et al.*, 2011). Examples include the biotechnology industry where companies face the ‘market’ and ‘academic science’ logics (Murray, 2010). A second example is from social enterprises which often try to integrate the ‘commercial’ and ‘social’ logics (Pache & Santos, 2013). Lastly, community banks struggle with the incorporation of the ‘financial’ and ‘community’ logics (Almandoz, 2012). The emergence of institutional complexity is a result of uncoordinated action from institutional actors who present their own logics as more unique and legitimate than the others (Besharov & Smith, 2014).

Institutional Complexity in ASM

Contextualizing institutional logics in the ASM industry reveals four important logics. Two of the logics originate among ASM actors and these are the market and community logics (Hotho *et al.*, 2020; Minbaeva *et al.*, 2020). A market logic manifests itself in profit maximization, efficiency and self-centeredness while a community logic displays social obligation and identification (Minbaeva *et al.*, 2020). Third, a political logic is also at play in this industry as

evidenced by literature on the resource curse theory (Funk *et al.*, 2020). Fourth is a civil society logic in which civil society organizations provide training and financial aid to ASM in a bid to create model sustainable ASM operations (Laurence, 2011). As such, numerous logics presenting their guiding principles to one institutional field arise, and this presents a theoretical puzzle (Besharov & Smith, 2014).

The four ASM logics originate from uncoordinated actors and carry divergent objectives. Under the market logic, ASM actors individually acquire mining rights or informally engage in mining with an individual profit maximization objective. These actors have less interest in social or environmental sustainability (Bansah, 2019). ASM practices under a market logic involve targeting of easy to mine, high value minerals such that actors shift from one area to another leaving behind a trail of environmental damage (O’Faircheallaigh & Corbett, 2016). In addition, several social ills such as poor sanitation, substance abuse and sexual violence against women are associated with this logic (Buxton, 2013b; Rustad *et al.*, 2016).

There are two variants under the community logic. In the first, community leaders mobilize their people to exploit mineral resources within their communities with a community development objective. A second variant of the community logic appears as socially organized groups of ASM actors who work for collective good with an objective of poverty alleviation (Chipangura, 2019). An example given by Chipangura (2019) is from the Mutanda village in Zimbabwe, Southern Africa. In this area, ASM actors work together in a manner structured by apprenticeship processes, family-like connections, and organized groups. Zvarivadza (2018) compliments this logic by asserting that joint ventures and mining associations are viable forms of sustainable management of the ASM sector.

The political logic originates from the state with the objectives of legal compliance and state profiteering (Funk *et al.*, 2020). An example of this logic is detailed in Mawowa's (2013) paper on the political economy of the small-scale gold mining, which reveals consequences of the politics of extraction and trade control by the state on a mining site called Totororo in Central Zimbabwe. This study reveals that the political logic is also characterized by elite accumulation and patronage (Mawowa, 2013).

The civil society logic is brought by Non-Governmental Organizations (NGOs) who carry a sustainable development objective. These NGOs only finance one or two mining operations to demonstrate how a sustainable ASM operation should practice. The NGO objectives remain beyond the reach of other operations that lack such financial aid (Laurence, 2011). Consequently in the ASM sector, there are a significant number of pilot projects reliant on donor funding and philanthropy which, however, never scaled (Peyser & D'Esposito, 2021).

It follows that an ASM actor is faced with several operating guidelines that are not easily reconcilable. If an actor wishes to pursue a market logic, they face resistance from environmental, legal and community lobbyists. To pursue a community logic like the organized groups in Chipangura's (2019) study, actors still face legal and environmental resistance. A political logic is unpopular with ASM actors since, first, it carries legal compliance hurdles that are usually too expensive to meet for actors at the base of the pyramid. Secondly, the political logic is marred with elite accumulation and patronage, hence undesirable to ASM actors. Lastly, the civil society logic offers demands such as proven geological reserves, proven financial flows, proven legal compliance and proven management capacity before financial aid is given. These demands coupled by a lack of scalability and high sustainability expectations make the civil society logic incompatible with the market and community logics. The result of

this incompatibility of logics is persistent informality in the ASM sector as actors try to avoid demands that affect financial performance of their operations (Siwale & Siwale, 2017).

Current State of Research

The consequences of logic multiplicity within organizations have been examined, with divergent conclusions being reached. One line of argument associates multiple logics in organizations with contestations and conflicts (Battilana & Dorado, 2010; Zilber, 2002). Other arguments point to coexistence or in other words logic blending (Binder, 2007; McPherson & Sauder, 2013). Additionally, some researchers portray logic multiplicity as a threat to organizational performance with the potential to ultimately bring about organizational demise (Tracey *et al.*, 2011). Lastly, another school of thought argues that the presence of multiple logics is a good recipe for organizational endurance, sustainability, and innovation (Jay, 2013; Kraatz & Block, 2008).

All these arguments are yet to be tested in an institutional field where more than two competing logics exist. This study, therefore, sets out to generate an understanding of how logic multiplicity affects financial performance and sustainability in ASM, where four logics exist. Sustainability, in the mining industry is often conceptualized as a five dimensional agenda comprising the environment, society, the economy, safety and resource efficiency (Laurence, 2011). In this study, we limit our scope to the first three dimensions. In addition, for the purposes of this study, we use the term sustainability when alluding to environmental and social dimensions while financial performance represents the economic dimension. We treat the economic dimension separately to see the effect of pursuing sustainability goals on financial performance at the base of the pyramid. This assessment is necessary since ASM is a sector

that is primarily poverty driven (Dreschler, 2001; Hilson *et al.*, 2016; Hilson & Maponga, 2004; Zvarivadza, 2018).

Hypotheses Development

In most institutional fields, small actors enjoy a peripheral location and are therefore, motivated to deviate from sustainable behavior since they are less restricted by institutionalized demands and relationships (Battilana & Dorado, 2010; Leblebici *et al.*, 1991). This peripheral location allows ASM actors to operate under a market logic with limited yielding to institutional demands. As a result, a market logic which follows self-interested behavior, profit maximization and efficiency may not positively contribute towards sustainability in ASM. We, therefore, hypothesize that:

- (i) *Pursuing a market logic in ASM has no potential for achievement of sustainable development outcomes though it assures financial performance of involved operations.*

The imposition of cooperatives in a community logic conflicts with a market logic and facilitates exploitation of labor (de Haan & Geenen, 2016). However, borrowing insights from a separate albeit related field of renewable natural resources such as fisheries, the work of Elinor Ostrom theorizes that rules prescribed externally have minimal success in the management of the commons (Harvey, 2011). By positing this view, Ostrom pushes forward a community logic asserting that decentralized community-based approaches are, though not always the best, an effective form of institutional logic (Ostrom, 1990). Nonetheless, since mining is capital intensive and communities in question are poor, the sharing of little resources

from little investment may not result in significant financial performance. We, therefore, hypothesize that:

- (ii) *A community logic in the exploitation of common pool non-renewable resources by community actors is an ideal institutional approach for sustainable development but it doesn't assure involved communities' high financial earnings.*

Under the political logic, resource rich countries have made attempts to pursue a resource nationalization agenda. Literature from political science has documented how this approach has often failed (Harvey, 2011). In ASM, several cases exist too, where the state has attempted to assume totalitarian control of resource exploitation only with minimal success (Dreschler, 2001; Mawowa, 2013). Various states have often instituted ASM bans in order to promote state controlled mineral exploitation but that has fueled (re)engagement by former ASM actors in criminal and rebel activities (Stoop *et al.*, 2018). We, therefore, further hypothesize that:

- (iii) *State control of resource exploitation in ASM results in entire field demise, hence low chances of achieving either sustainability goals or financial performance.*

The ASM sector has a significant number of pilot projects reliant on donor funding and philanthropy which, however, never scaled (Peyser & D'Esposito, 2021). These mining projects reflect a civil society logic. This logic was particularly explored by Laurence (2001) who concluded that such an approach is only useful for few handpicked model operations but cannot resolve the whole sectoral fiscal crisis. Hence, we hypothesize that:

- (iv) *A civil society aid logic is useful for achievement of sustainability outcomes while assuring actors of financial performance. Nevertheless, this logic suffers scalability challenges.*

At the corporate level, many studies have pointed to hybridization as an escape route from logic complexity (e.g. Battilana & Dorado, 2010; Dunn & Jones, 2010; Fox-Wolfgramm *et al.*, 1998; Greenwood & Hinings, 1996; Jarzabkowski *et al.*, 2010; Pache & Santos, 2013; Smets *et al.*, 2012). In sustainability literature, organizations that have adopted the hybridization of logics for sustainable development have subsequently, boosted their overall performance (Artiach *et al.*, 2010; Choi & Lee, 2018; Weber, 2017). On the backdrop of these arguments, we hypothesize that:

- (v) *Hybridizing institutional logics in ASM results in the achievement of sustainability goals and improvement of actor financial performance.*

METHODOLOGICAL APPROACH

Studying the multiple and dynamic aspects of systems such as ASM both within and outside the boundaries of sustainability requires a departure from linear, theoretical models available in literature. We make this assertion based on evidence available in studies from several fields in the social sciences, such as public health (Berman & Cuizon, 2004; Biglaiser & Ma, 2007; Eggleston & Bir, 2006; González, 2004; González & Macho-Stadler, 2013). The suggested methodological approach is one that acknowledges the holistic, complex and adaptive nature of such systems and their *broader* environment (Paina *et al.*, 2014; Sterman, 2000). Complex systems comprise several interacting elements that organize themselves in a dynamic manner;

that are normally unpredictable in the long-run; and yet can learn from past experiences (Adam & De Savigny, 2012; Paina & Peters, 2012; Tan *et al.*, 2005). Paina *et al.*, 2014 further asserts that, a research design that acknowledges complex systems' features, together with potential interactions from contextual factors is suitable to guide exploration of complex phenomena from multiple perspectives. The usefulness of such a methodological approach is that it facilitates the exploration of complex system features that include feedback, emergence, and self-organization. Considering the multiplicity of logics and numerosity of contextual factors in ASM sustainability we, therefore, hypothesize that:

- (vi) *A research methodology acknowledging complex systems' features, together with potential interactions from contextual factors is ideal for unravelling consequences of institutional complexity, foster sustainable development and test for financial performance.*

Going forward, we use case studies of ASM communities in Zimbabwe to investigate the consequences of institutional complexity and key patterns and interactions that it breeds. We focused only on formal ASM actors. We collected views of ASM stakeholders through 6 focus group discussions and 13 key informant interviews done with ASM actors, government agents and civil society representatives between the years 2018 and 2019. To supplement the interview data, we used archival data from 5 databases namely Delve, MapX, EITI Data, artisanalmining.org and the African Minerals Geoscience Initiative. The study also involved review of policy documents and reports by developmental organizations as well as insights from academic papers. Using this information, we proceeded to develop qualitative Systems Dynamics (SD) models.

SD is a modelling approach well established in systems science. SD modelling comprises the explicit modelling of feedback, more specifically circular causality between cause and effect. Secondly, the approach focuses on modelling of stocks which explain state variables such as production and flows, as well as rates such as change in production. In the SD models, words connected by arrows represent variables. Arrows or loops represent causal links between variables or between variables and stocks. Broken arrows or loops denote shadow causal links. Boxes refer to stocks, pipes/tubes connected to boxes represent flows (i.e., rate variables that cause stocks to change over time). Arrows have polarity at the arrowhead and polarity denotes the effect of the back-end variable on the front-end variable. A positive polarity does not mean a positive influence in certain behavior but rather the effect of amplifying certain behavior. Negative polarity exhibits an inverse relationship i.e., an increase in the back-end variable results in a decrease in the front-end variable.

MODELS FOR SUSTAINABILITY AND FINANCIAL IMPLICATIONS OF DIFFERENT LOGICS

In this section, we explore the sustainability and financial performance of pursuing the five different identified logics – market, community, politics, civil society, and the hybrid logics. We performed this illustration in two stages. First, we developed a qualitative graphical model of the status quo of the ASM system in Zimbabwe (wherein the first four logics prevail). Second, we developed a qualitative model of a possible structure of the same system under a hybrid logic. The first model helped reveal leverage points for the second model.

ASM logics versus sustainability and financial performance: status quo

Figure 2 is an SD model showing the first four institutional logics prevalent in the Zimbabwean ASM sector and how they relate with sustainability goals and financial performance. We

decided to model the status quo with the 4 existing institutional logics put together, to evaluate the overall effect that the four logics have on overall sustainability and financial performance of ASM operations. The main sustainability variables on which all four logics load their impacts are negative environmental impacts and social ills. Negative environmental impacts result from impact per ton of production, poor state regulation and mine life. Mine life refers to the length of time a mining operation exists on the same geographic location. As mine life increases, negative environmental impacts are minimized since ASM actors cease to be nomadic – a practice which leaves a trail of environmental damage. However, as impact per ton and poor state regulation increases, negative environmental impacts also increase. Impact per ton is a function of production. As production increases, impact per ton also increases since more land is required such that more deforestation and more disposal of mine waste occurs. Poor state regulation is characterized by lowly remunerated state agents who engage in corrupt practices at the expense of the environment. These agents collect bribes from ASM actors and allow environmental damage to continue.

Financial performance is affected by the income of ASM actors, variable costs, fixed costs, and poor state regulation. As income of actors increase, financial performance also increases. However, as variable costs, fixed costs and poor state regulation increase, financial performance decreases. Poor state regulation affects financial performance through demand for bribes and disputes over property rights. Financial performance also affects change in production. As financial performance increases actors can improve their production capacity. The same effect occurs through increased access to technology. However, poor state regulation and negative environmental impacts cause a decrease in production. Poor state regulation means inconsistent regulation which slows down production, e.g., changes in Zimbabwean gold marketing regulations between 2014 and 2019. In this period gold marketing changed 3

times from 100% foreign currency pricing to 70%-30% foreign-local currency pricing and finally 55%-45% foreign-local currency pricing. On the other hand, negative environmental impacts can occur through inefficient resource use such as failure to recycle process water. The result is higher production costs, hence a negative impact on production.

Social ills are a function of workforce skills and educational level, impact per ton and mine life. As workforce skills and educational level increases, social ills decrease since workforce has increased awareness in terms of responsible behavior e.g., better reproductive health awareness. As mine life increases, social ills decrease since ASM actors are forced to remain within one locality such that spread of ills e.g., sexually transmitted diseases are limited. Wage per person in turn affects workforce skills and educational level, as, through higher wages, ASM actors can attract a skilled and educated labor force. Wage per person is dependent on access to capital. As access to capital increases, wage per person also increases. Wage per person also affects variable costs such that an increase in wage per person results in a corresponding increase in variable costs. The resultant effect becomes a decrease in financial performance.

Access to capital is a major determinant of both sustainability and financial performance. Capital is accessed through cash injection from either the state, civil society, or other financial institutions. However, state cash injection is only possible in an efficient state mining logic. As access to capital increases, fixed costs also increase. As fixed costs increase, access to technology and investment in geological exploration increases. Increase in geological knowledge means ASM actors are able to stay in one location for longer, hence a longer mine life. Increase in access to technology means actors can employ mining and mineral processing technology that enables them to exploit lower grade mineral bearing rock. As a result, improved

access to technology results in an increase in mine life. In the same vein, a rise in mineral price means an extension of mine life as actors can now profitably exploit lower grade mineral bearing rock.

We identified several shadow variables and causal links. Most of the shadow causal links refer to relationships emanating from specific logics. Examples of these relationships are adoption of state mining in its efficient or inefficient form, a collective mindset from the community logic and cash injection from the civil society logic. Adopting efficient state mining logic results in increased access to capital, increased income and minimized impact per ton. However, this is only an ideal case since the inefficient form of state mining is what always prevails. Inefficient state mining is characterized by corruption, mismanagement, and incompetence such that impact per ton increases, variable costs increase and income decreases. Civil society capital injection increases access to capital and variable costs while reducing impact per ton. Impact per ton is reduced through promotion of sustainable mining practices. An increased collective mindset from the community logic, reduces impact per ton but increases variable costs through investment in sustainable mining practices.

Outside the control of ASM actors, the state is responsible for legislative functions and tax collection. Legislative functions include change in mining laws which can reduce mine life. An example is the 2006 ban on ASM in Zimbabwe. On the other hand, poor state regulation results in diminished tax revenue flow as revenue collection agents profit on behalf of the state. However, an increase in ASM actor income results in increased revenue flow to the state.

Insert Figure 2 about here

Sustainability and Financial performance of ASM under a hybrid logic

Figure 3 shows a hybrid model that combines the first four logics in ASM and evaluates the effects of the resultant hybrid logic on sustainability outcomes. Red causal links indicate changes that have been made from the original model in Figure 2. Thick causal links represent amplified positive impacts because of hybridization. Under a hybrid logic, all the first four logics are combined with some modifications such as limiting the state role to regulation rather than enterprising, and channeling civil society aid into the community and offer intermediary functions like training and monitoring. With a more efficient regulatory practice that can involve digitalization and high financial performance, the negative agency effect of the state is dissolved. Investment in exploration – a process of generating geological knowledge is important for both extending mine life and increasing access to capital from various funding institutions. The result of these modifications is increased sustainability performance as well as financial performance from all the actors.

Insert Figure 3 about here

DISCUSSION

The results of the qualitative modelling process confirm all the 6 previously generated hypotheses. As asserted in hypothesis (i), a market logic assures actors of high financial performance but lower sustainability impact through increased environmental damage and increased social ills. In turn, a community logic results in low financial performance due to sharing of diminished profits after investing in lowering environmental and social damage as asserted also in hypothesis (ii). A logic of politics achieves less in every observed outcome because of agency corruption, mismanagement, and incompetency. As gathered from the focus

group discussions and key informant interviews, state agents, being lowly remunerated become corrupt and pursue self-service at the expense of the state. Hence, the political logic results in low financial performance and high social and environmental damage. The civil society logic depends on the flow of funds from donors and as pointed out under hypothesis (iv), this logic results in high sustainability outcomes and financial performance but is limited in terms of scalability to the whole ASM sector.

At the corporate level, the effects of pursuing sustainability objectives on firm financial performance have been widely investigated. Several empirical studies have concluded that firms pursuing aggressive corporate sustainability investments, consequentially enjoy greater financial performance (Artiach *et al.*, 2010; Choi & Lee, 2018; Clarkson, 1995; Cornell & Shapiro, 1987; Donaldson & Preston, 1995; Mitchell *et al.*, 1997; Weber, 2017). However, other studies have concluded otherwise. For example, some studies show a negative relationship between corporate sustainability and financial performance (Gingrich, 1995; Lioui & Sharma, 2012; Nollet *et al.*, 2016; Walley & Whitehead, 1994). Other studies show no link between corporate sustainability and financial performance (Fogler & Nutt, 1975; Freedman & Jaggi, 1982; Rockness *et al.*, 1986; Wiseman, 1982)

The question on how this relationship manifests in an institutional field such as ASM might have been answered in this paper. As shown in Figure 2, pursuing the four logics separately results in cumulative balancing effects on sustainability outcomes such that the ASM sector doesn't progress neither socially, environmentally nor financially. In line with hypothesis (v) and as indicated in Figure 3, a hybrid logic that comes with some modifications to the original logics has the potential to help ASM realize both sustainability and financial performance. As a result, the answer to the main question asked in this research is that sustainability can be

achieved through hybridization of logics in ASM, and the pursuit of sustainability does not diminish chances for financial performance. This finding is supported by Reay and Hinings (2009) who concluded that collaborative relationships are the means for managing rivalry between logics and promote logic co-existence. As further support, hybridization at the organizational level has been concluded as an escape route from logic complexity (Battilana & Dorado, 2010; Dunn & Jones, 2010; Fox-Wolfgramm *et al.*, 1998; Greenwood & Hinings, 1996; Jarzabkowski *et al.*, 2010; Pache & Santos, 2013; Smets *et al.*, 2012).

Study implications

Our study has four implications on management research and practice. First, prior studies examine the implications of institutional complexity in fields or organizations with only two logics. Our study contributes to management theory by examining institutional complexity in a field with four institutional logics. This contribution answers Greenwood *et al.*'s (2011) call for future studies to appreciate the prevalence of a multiplicity of logics in any particular context at any given time. These authors emphasized how important it is to be more explicit in justifying which logics are incorporated into the analysis. Our study illustrates how all the available logics have a resultant impact on sustainability outcomes and how their rivalry can be overcome to achieve sustainable development.

Second, our study confirms that investment in sustainability practices can result in improved financial performance even at the base of the pyramid. The relationship between corporate sustainability and financial performance has been extensively investigated at corporate level (Ambec & Lanoie, 2008; Awaysheh *et al.*, 2020; Barnett & Salomon, 2012; Cochran & Wood, 1984; Esteban-Sanchez *et al.*, 2017; Grewatsch & Kleindienst, 2017; Hart & Ahuja, 1996; King & Lenox, 2001; Lu *et al.*, 2014; McGuire, 1988; McWilliams & Siegel, 2000; Orlitzky *et al.*,

2003; Porter & Linde, 1995; Van Beurden & Gössling, 2008). Our study adds a new angle as it comes from institutional actors whose characteristics differ from large corporates. However, our study does not claim victory over the inconclusive debate on the relationship between corporate sustainability and financial performance.

Third, as asserted in hypothesis (vi) our study has attempted to apply a methodological approach that employs holism and acknowledges complexity and adaptability of dynamic systems (Paina *et al.*, 2014; Sterman, 2000). It appears that this methodological approach could be suitable for understanding complex sustainability challenges as well as revealing leverage points for policy formulation or improvement. Hence, the SD method can be useful to both social science research as well as management practice.

Finally, the results of our study highlight possible leverage points for ASM policy makers. Identifying these leverage points is important since the prolonged informality of ASM is a manifestation of poor governance (Hilson, 2013; Hilson *et al.*, 2017; Hilson & McQuilken, 2014). Converse to this assertion, de Haan (2021) argued that ASM formalization has a strong potential for advancing good governance. Our study points out some leverage points for ASM governance. These points include relinquishment of state control and agency, investment in education and training and geological exploration. Policy makers can apply such approaches for countries with ASM industries to realize the good governance potential they possess.

Limitations and future directions

In SD modelling, models are generated through a collaborative approach in which all stakeholders are involved mostly through modelling workshops. Alternatively, a researcher can develop SD models which should then be circulated among experts for critiquing and

refinement. In this study, we applied the latter approach but only achieved limited circulation of the developed models. This limitation means there is still room for wider consultation and refinement of the models. However, though this is the conventional way, and it normally results in models different from the original one, Box (1976) argues that ‘all models are wrong, but some are useful.’ This leaves us with an assurance that the models that we developed can still be useful. The second limitation of our paper is that it ended at a qualitative stage. SD allows quantitative modelling of systems such that implications of different actions and decisions can be assessed in terms of their quantitative significance. In that light, we intend to work on a separate, follow up study that seeks to investigate the quantitative effects of pursuing the various logics in ASM.

CONCLUSION

The dynamics of institutional complexity in organizational fields with more than two logics is an underexplored area. Furthermore, the pursuit of sustainability objectives amidst institutional complexity represents a study area requiring more attention. The theoretical puzzle toughens when sustainability should be achieved within an institutionally complex base of the pyramid. Against this background, we investigated the capacity of ASM to pursue sustainability and how that affects the financial performance of an industry at the base of the pyramid. The results of our study show that a hybrid logic has the potential to unlock sustainability in ASM, while assuring actors improve the financial performance of their operations. Secondly, our study makes a methodological contribution to the fields of institutional logics and sustainability by employing systems science as a methodology for understanding complexity.

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FIGURE 1: Source: SDG Report 2020

Total aggregate greenhouse gas emissions of developed and developing countries (gigatons of equivalent CO₂)

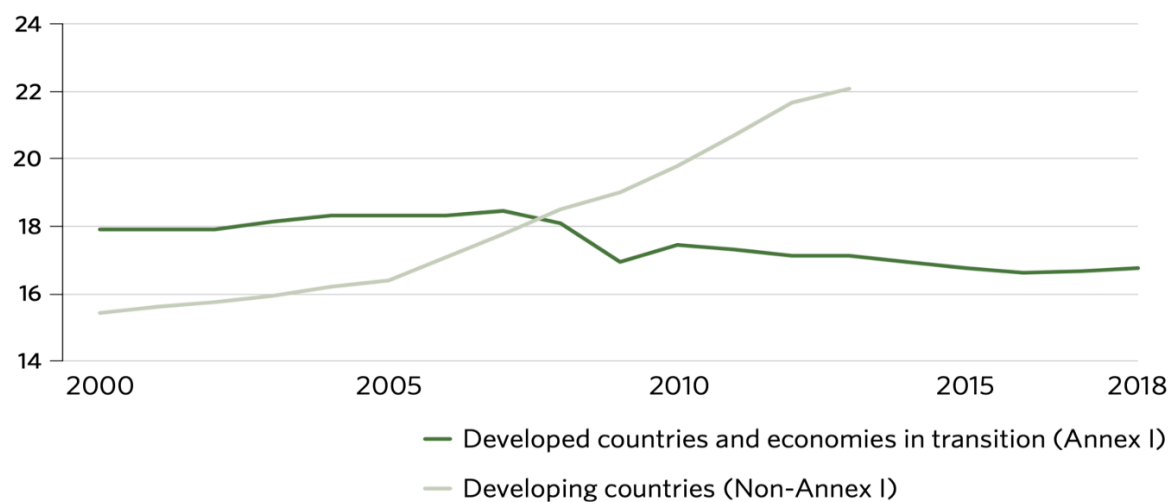


FIGURE 2: How the logics of community, market, politics, and civil society affect sustainability outcomes and financial performance in ASM: Zimbabwean case (own illustration)

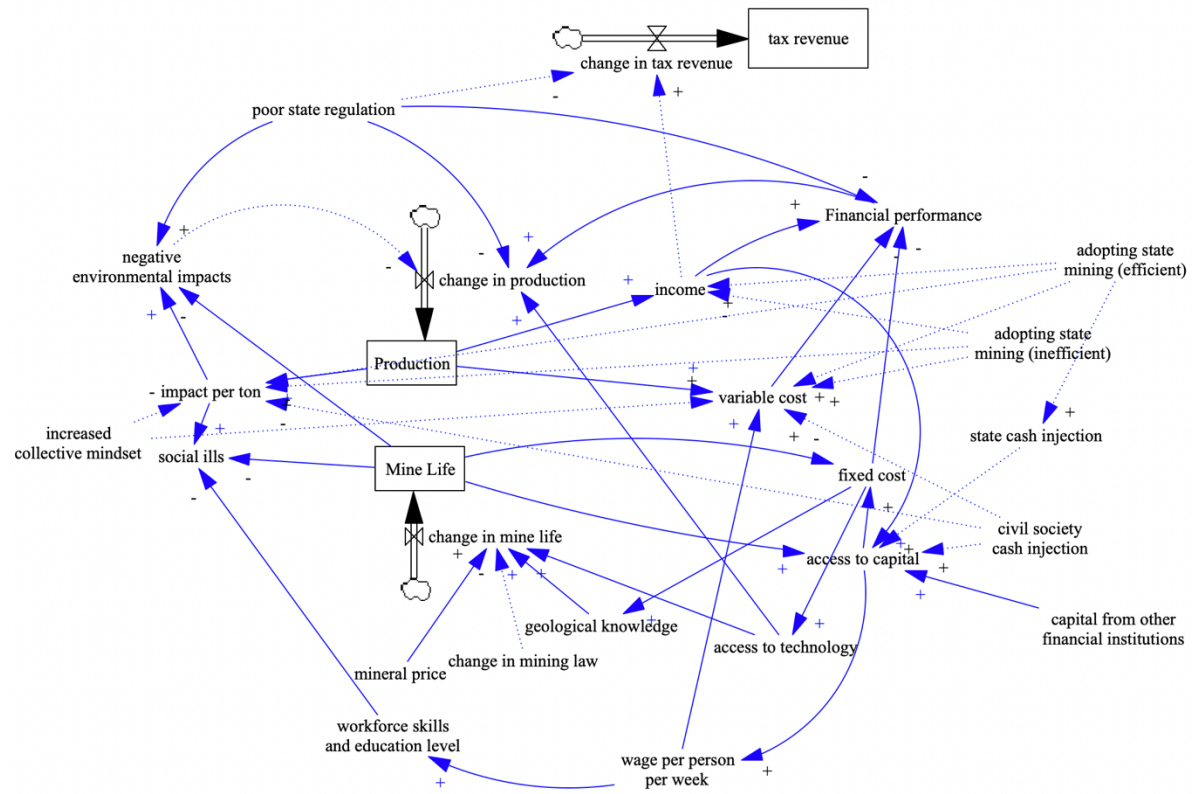
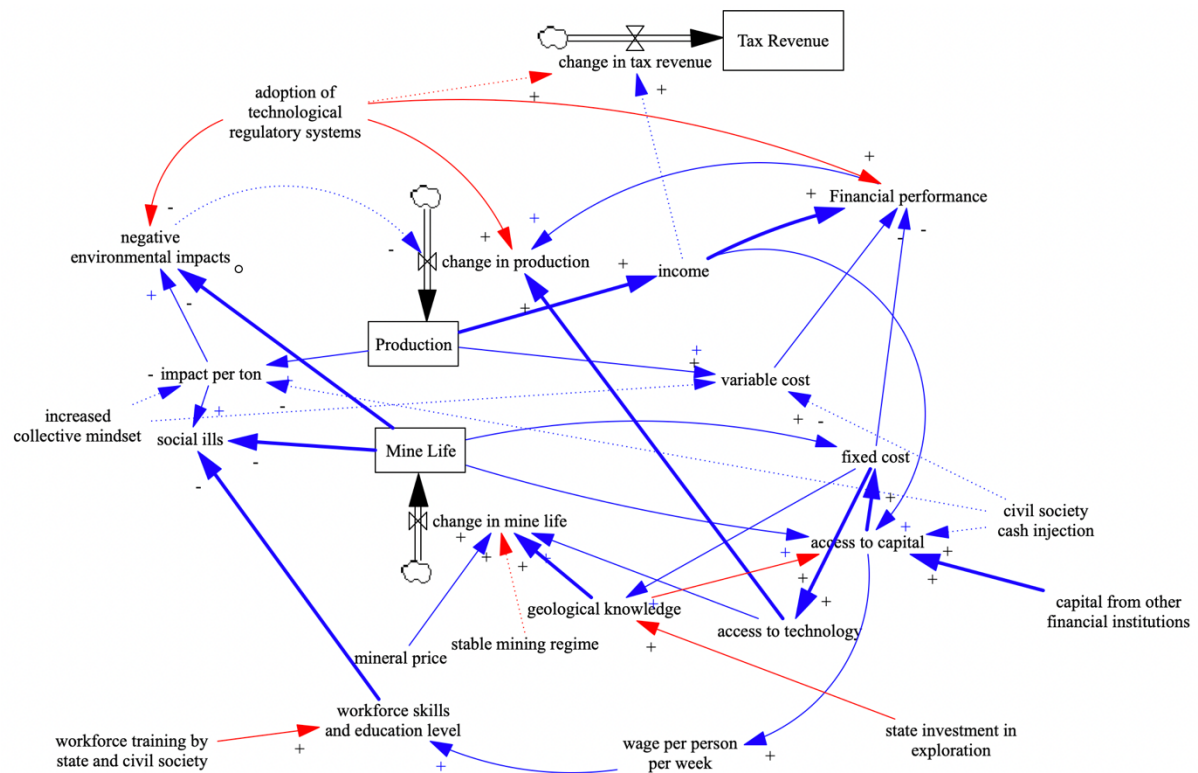
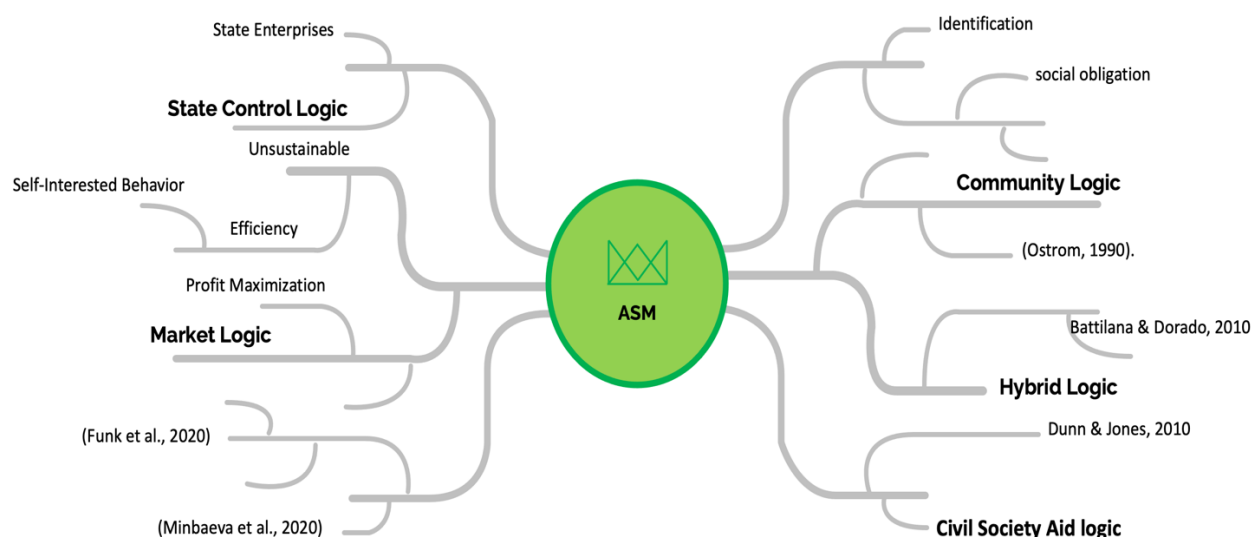


FIGURE 3: The hybrid logic suggested for ASM and how it affects financial and overall sustainability outcomes at the ASM field level (own illustration).

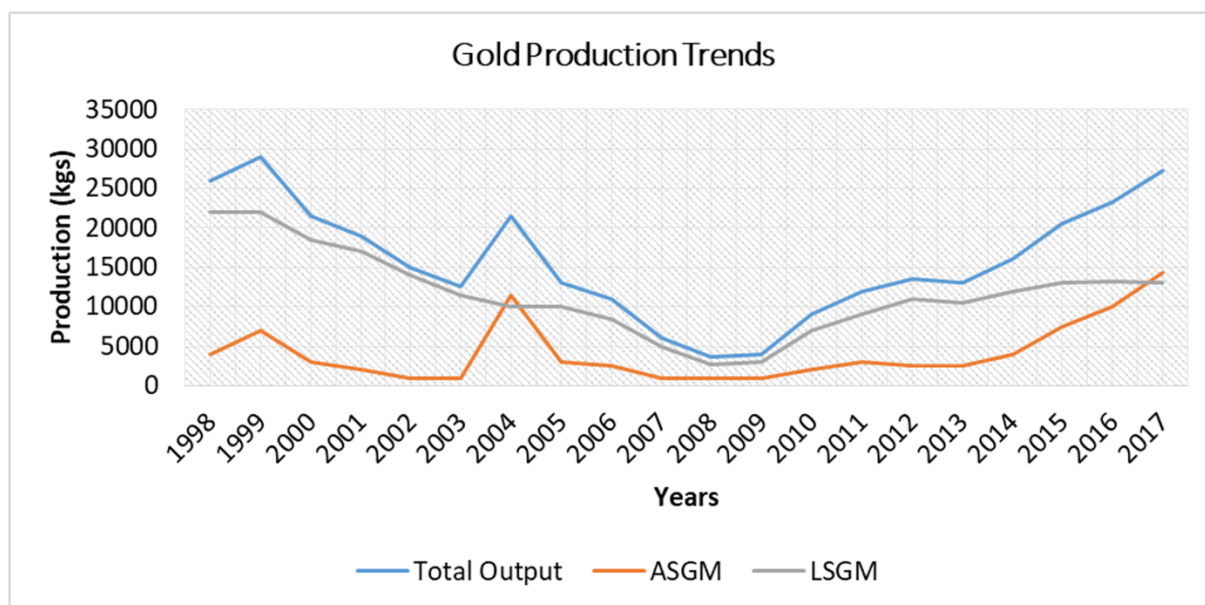


APPENDICES

APPENDIX A: Reference modes for institutional logics in ASM



APPENDIX B: Gold production trends in Zimbabwe from 1998 to 2017



Gold production trends for both ASGM and LSGM for the twenty first century (Chamber of Mines of Zimbabwe, 2016; RBZ, 2016 & ZMF, 2018)

APPENDIX D: Logic description and key features

Logic description

Market,
individualistic/self-interested,
profit maximization, no regards
to environment or society

co-op of communities
living together, they have a
specific location in mind

civil society, NGOs providing
capital and training to a specific
small scale mining operation
with the goal of demonstrating
sustainable mining. The
environmental and social
regulations and norms of the
funding country apply to the
operation.

state mining, establish state controlled mining
centers and ask all miners to acquire equipment,
technical knowledge and processing facilities from
the state run mining centers and in turn sell all
their produce.

Main characteristics

Minimum fixed cost investment
leads to very short mining life. Most
productive mining due to disregard
of regulations

Community interested, regards for
environmental and social impacts.
Equal profit sharing among
participants.

comes with funds and a philosophy of sustainable
development. The most stringent environmental
and social regulations. Increased mine life relative
to market and co-op scenario due to geological
knowledge and access to technology increase.

Temporary and difficult to scale. Their objective
is to create a use case for new, innovative
technologies/processes that will reduce
environmental and social impacts while bringing
a long term financial gain.

State interested and want to encourage legal
compliance, leading to reduced environmental
and social impacts. Self-interest by state agents
reduces the efficiency of state run enterprises.