UNIVERSITÀ DEGLI STUDI DI PALERMO

Modelli per il miglioramento della performance nel settore pubblico
Dipartimento di Scienze Politiche e delle Relazioni Internazionali (DEMS)
SECS-P/07

A DYNAMIC PERFORMANCE MANAGEMENT APPROACH TO ASSESS HOW DECENTRALISATION POLICIES MAY REDUCE ENVIRONMENTAL POLLUTION FROM MINES IN ZAMBIA

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CICLO XXVI
ANNO CONSEGUIMENTO TITOLO 2017

DEDICATION

To my son, Tatenda Jeremiah, you are my love and joy.

DECLARATION OF ETHICS

This research was presented within the guidelines outlined in the Ethics Code of Conduct from the University of Palermo, (Italy), University of Bergen, (Norway) and University of Radboud, (Netherlands). The research methodology received clearance from the mentioned universities

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ACKNOWLEDGEMENTS

From the very onset, I express my deep sense of gratitude to Dr. Federico Cosenz, who had the time to give guidance and counsel throughout my entire research. I extend the same to Professor Carmine Bianchi, who opened this new world of opportunity and thinking.

I would be amiss if I did not extend my appreciation to academic institutions that formed my resolve in this field of study, at the University of Bergen (Norway) and Radboud University (Netherlands).

My special thanks go to the different stakeholders who participated in this research by giving me the necessary information and assistance. Lastly, I would be incomplete without my family, who have stood by me during this challenging but wonderful journey.

February, 2017.

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LIST OF ABBREVIATIONS

CEP	**Copperbelt Environment Project**
DIP	**Decentralisation Implementation Plan**
EIA	**Environment Impact Assessment**
ECB	**European Central Bank**
ECZ	**Environmental Council of Zambia**
EMA	**Environment Management Act**
EPPCA	**Environmental Protection and Pollution Control Act**
IMF	**International Monetary Fund**
IUCN	**International Union for Conservation of Nature and Natural Resources**
MMD	**Movement for Multi-Party Democracy**
NEAP	**National Environmental Action Plan**
NCDP	**National Commission for Development Planning**
NPG	**New Public Governance**
NPM	**New Public Management**
PMS	**Performance Management System**
PSE	**Public Sector Efficiency**
SADC	**Southern Africa Development Community**
UNEP	**United Nations Environmental Programme**
WCED	**World Commission on Environment and Development**
WHO	**World Health Organisation**
ZCCM	**Zambia Consolidated Copper Mines**

ZEMA   **Zambia Environmental Management Agency**

ABSTRACT

The economics of pollution in general and pollution control in particular is a relatively new branch of economic science. This has brought about economic and social interest due to the fact that most of the pollution is caused by economic activity such as mining. Pollution from mining has become a world-wide problem. While environmental problems vary in detail, it is a fact that mining emits damaging pollutants, a reason this study was undertaken. As a result of this, threats to the environment and human health continue to escalate.

This research aimed at investigating how a Dynamic Performance Management approach, through System Dynamics, may support policy-makers and public managers in improving the usage of decentralisation policies to reduce environmental pollution from mines. The study focused on Zambia, where mining has posed challenges to the environment and the surrounding populations for a number of years without being detected or taken seriously. Taking the case for Kabwe, a town within the Central province, it was found that even in cases where the harm from pollution to human health has been known, very little has been done to curb this.

In terms of public governance, the state faces new challenges of having a more efficient and effective public sector, which is able to adapt to global developments. Hence, in matters such as environmental pollution, political considerations remain at the core of every policy decision made and ultimately its implementation. One of the major elements that are used to underpin the New Public Management is decentralisation. While this has not been used successfully in the execution of policies that can create sustainable economic approaches towards mining, it still remains relevant in Zambia's public administration.

Using a Dynamic Performance Management approach, the risks or problems associated with adopting such policy measures in situations where government policy is not clearly understood and fully implemented, were studied. As a result of this, the evidence showed that implementation of any governance approach required a well-functioning public sector, which can exert pressure to be able to manage decentralisation effectively.

CHAPTER 1   BACKGROUND TO THE STUDY

1.0 Introduction

Mining contributes significantly to foreign exchange earnings in gross domestic terms for a number of developing countries. Globally, mineral extraction has moved from small scale investments to large scale ventures, mostly dominated by a concentrated group of transnational corporations. This is especially the case in developing countries. But such mining operations have also had a serious impact on the environment and consequently the people living in the vicinity of the communities where this mining is done, most of whom are poor, rural and indigenous (World Bank, 2010). Consequently, wherever mining has occurred, there will always be some element of pollution involved (Lindahl, 2014).

Zambia is a landlocked country located in the southern part of Africa. It is a middle lower income economy and one of the most urbanised countries in Southern Africa with a population of about 13 million people. The Mines and Minerals Act of Zambia is the legal authority that allows any entity or institution in the country to explore, use and manage natural resources in order to bring mineral wealth to the people. It vests all the rights of ownership in, searching for, mining and disposing of minerals located in the Republic, in the President. Since independence in 1964, mining has been Zambia's main economic earners, with copper as the major product. It has two of the largest mines in Africa and is one of the largest producers of copper in the world.

But there is a conundrum when viewing the extent of mining in the country-and it has to do with the environment. The Environmental Performance Index lists Zambia as being one of the highest countries with air pollution problems. This index uses indicators that measure population weighted exposure to particulate matter in Micrograms per cubic meter (Mg/m3) and the average of the population exposed to Particulate Matter (PM) of 2.5 levels at 10 mg/m3, 15mg/m3, 25mg/m3 and 35mg/m3. These are the levels that represent the World Health Organisation (WHO) air quality guidelines.

Particulate Matter is a measurement used in detecting the amount of hazardous substances found in the atmosphere. According to data provided by the ZEMA, Zambia has three times the level of pollution allowed from mining activities (ZEMA, 2015).

1.1 Economic growth and GDP per capita

Mining creates a number of positive factors to the development of the country. It is a major contributor to the Gross Domestic Product (GDP), accounting for 7.5 per cent of the growth. The main minerals mined are copper and coal, ranking sixth and fifth in world rankings respectively (KPMG, 2013).

While the mining sector brings economic earnings, mining and mineral processing in Zambia has presented not only environmental hazards but a huge legacy of cumulative air and water pollution, waste and land dereliction for the many years it has been a significant mining country. Many areas suffer from the pollution legacy of many decades of mining (Lindahl, 2014). Levels of pollution due to mining activities have now become a subject for discussion at both the local and international levels. In some places, such as in Kabwe, where this case study was based, detrimental effects of pollution from abandoned mines continue to affect human, animal and vegetable life (Clark, 1975).

1.2 Pollution Legislation

The main legislation on pollution is the Environment Management Act (EMA) of 2011, whose aim is to ensure the sustainable management of natural resources and protection of the environment. It also aims to control and prevent pollution. Through this act, the Zambia Environmental Management Agency (ZEMA) was created as the lead agency on matters pertaining to Environmental Impact Assessments (EIA), and one of its mandates is to establish inspectorates with necessary technical staff who can administer, monitor and enforce measures for the protection of the environment and prevent pollution. The agency is also empowered by the EMA to identify projects, plans and policies for which an EIA can be carried out (SADC Environmental Handbook, 2012).

Section 32 of the EMA compels the courts to fine or imprison any person that causes or permits the discharge of a contaminant or pollutant and in addition the court can direct any such person to clean up the polluted environment and remove the effects of pollution to the satisfaction of the Agency.

Notable, too, is that the Act gives power to the minister responsible for the environment to establish requirement standard guidelines. These are used to provide guidance for preventing and controlling discharges into the environment, as well as for the monitoring of these discharges of pollutants or contaminants. The Act also provides the statutory limits for selected emissions from various mining activities as a way of managing environmental degradation.

Besides this legislation, Zambia has a national policy on the environment, whose purpose is to rationalise and harmonise all matters dealing with the environment through an integrated approach and consensus among all sectors.

1.3 Governance

Governance by itself is a complex term that might not be captured in one word. But for purposes of this research, it focuses primarily on governments and their agencies and how the governance system has impacted on the way the pollution from mining activities is managed.

Major theories around governance emanated during the 1980s, when the administrative state was called into question, as support for smaller and less intrusive governments that reduced the financial burden on individuals and property holders was seen as being ideal. Seemingly, it was observed then that the cost of running governments was going to break the bank. This later resulted into two movements; the first being the New Public Management (NPM), which took the market model as the best way of doing business, and the New Public Governance (NPG), which emphasised on the importance of taking a more collaborative approach to the provision of public services (Morgan et al, 2013).

1.3.0 New Public Management (NPM)

The NPM is determined to let government run as a business. In summary, it was meant to heighten efficiency, effectiveness, and creation of systems that develop the overall management, and governance of political actors, among others. It also strived to make the services provided by government more responsive and accountable to the citizens by focusing on competition and customer satisfaction, while placing substantive political values at the centre of governance (Yang and Holzer, 2006). Also known as Performance Management Systems, this form of management was meant to provide a systematic thinking in which

change could be implemented in the public sector. It was thus viewed, according to Crook and Manor (1998:89), "as a tool that had the potential to help the public sector to deliver set and agreed plans". The most common of these has been the experimentation with performance management initiatives, through the introduction of performance staff appraisals. This is where performance of individuals is put forward as a way of achieving a link between career rewards and sanctions (Polidano, 1999). The development of Performance Management Systems are also recognised to embrace critical values such as cost and efficiency measures; effectiveness measures such as outputs, outcomes and impacts; and qualitative measures such as satisfaction, responsiveness and quality of life (Stoker, 2006; Jorgensen and Bozeman, 2007). A clear success of this has been the implementation of the Performance Management Approach, which has been used for tracking both outputs and outcomes through the combination of an institutional with an inter-institutional perspective so that performance is enhanced and sustainable development is achieved (Bianchi and Rivenbark, 2012).

However, this form of management was seen as being too narrow in that it delineated political values as the centre of the governance debate. The reality in the case for Zambia is that it has been difficult for the public sector to cope with the reform programmes especially when governments change. Even though it is not a case of "one shoe size fits all', what is common about the new NPM are the general components, which include de-regulation of line management, conversion of civil service departments into free-standing agencies or enterprises as well as performance-based accountability (Aucoin, 1990).

1.3.1 The New Public Governance (NPG)

The New Public Governance, as emphasised by Shinn (2014: 5) is interested in advancing the value created by the Whole-of-Government activities, and not just improved efficiency, effectiveness or responsiveness in the implementation of a programme." Another key feature of NPG has been its emphasis on creating processes that generate stakeholder involvement. Hence, while NPM views politics as the accumulation of individual inclinations, NPG views politics as an expression of the valuable needs and preferences of citizens (Moore, 1995). In the case for Zambia, this has been seen practically in the way reforms in the delivery of health services to citizens at the local government level are now being managed. Such

measures have allowed for the creation of new policy measures, negotiation agreements with various stakeholders and the development of performance measures which were not there before.

The NPG movement equally views the creation of the public good as a co-production process involving the public, private and non-profit sectors (Osborne, 2006).

Evidently, the distinction for the two approaches is seen in the way they are applied in the private and non-profit sectors, where NPM's focus is primarily centred on delivering a service efficiently and effectively, but cheaply. The NPG on the other hand is interested in enhancing the capacity of the local organisations and in making communities to be self-reliant (Morgan and Shinn, 2014).

1.3.1 Decentralisation

One of the apparatus within governance that is arguably useful but at the same time challenging is decentralisation. While it is considered by others to fall out of the realm of the NPM (Polidano, 1999, Brunsson, 1993), it is viewed differently especially in developing countries, where emphasis is on the devolution of political power to lower levels (Robinson, 2014), who are the locally elected authorities. For purposes of this research, decentralisation is used for the latter purpose, concerning the transfer of responsibilities and authority from the higher echelons of power to the lowest form. But the jury is still out on whether decentralisation is indeed a form of the NPM or indeed outside its realm. What should be noted is that this form of governance, despite being effective especially in the developed world, is still far from being implemented in most developing countries.

In the developing world, political decentralisation is often seen as an integral part of central government reform because it entails that a large number of civil servants are transferred to local authorities and there is massive restructuring of the ministries (Crook and Manor, 1998). Also known as structural devolution, decentralisation entailed transferring authority from the central political-administrative level to regulatory agencies, service –producing agencies or state-owned companies. While the implications of this meant that the political and administrative leadership was deprived of aspects of control and influence of information, it has resulted in more autonomy for general agencies, regulatory agencies and government-owned companies and enterprises (Christensen and Laegreid, 2007:12).

One of the success stories for decentralisation can be seen in New Zealand, where it was used in the administration of the immigration department. The principles of decentralisation were applied by restructuring the department into a central policy group and creating a horizontal internal specialisation. It let 'managers manage and held them accountable for the results' (Christensen et al., 2014:116).

When decentralisation was first introduced just after independence in Zambia, there was no deliberate move to effectively implement it. This can be attributed to either lack of a clear understanding of what decentralisation entailed or perhaps the fact that being a newly independent state and a one party one for that matter, power was concentrated in one man, thereby making it difficult for certain ideas and policies to be implemented, which would in some way yield power away from him. It was only after the ushering in of multi-party politics in 1991 that the major action towards decentralisation was made.

With the creation of an environmental protection institution and the implementation of decentralisation, the question this raised was "how was Zambia's decentralisation helping in curbing the pollution from mining activities?" Analyses by Kalu (2013), Ncube, (2012) and Ngethe (1998) suggest that environmental governance is indeed a complicated and new arena in Zambia, partly due to a fragmented and evolving legislative framework as well as a lack of clarity in the division of roles and responsibilities across the different spheres of government.

It is against this background that this research was embarked on.

1.4 Research Problem

The rationale for the quest of creating a decentralised environmental management framework in Zambia revolves around the view that failure of the state in the management of the pollution from mining activities, especially in Kabwe, is due to the lack of a management approach to assess how decentralisation can be used as a policy matter, in the decision-making process by the central government. This research attempts to show how Zambia's public administration has tackled pollution from the mines, in the context of decentralisation, which is a governance issue. To do this, a review of the main policies formulated by government to protect and manage the country's environment has been done. Other pieces of legislation or policies that deal with governance have also been studied.

It has to be noted that before 1991, there was no deliberate effort by government to manage the pollution that was emanating from mining activities. This pollution has affected the health of humans, especially those living near the mining areas, where cases of kidney and liver problems as well as damage to the nervous system, have been recorded (Cernak, 2006). It was only after the return to multi-party politics in 1991 that the new administration changed its policy stance towards mining. Besides the mines being privatised, policy as well as pieces of legislation was put in place to take care of environmental pollution.

My thesis, simply stated, is the following: Decentralisation as a form of the NPM is the apparatus that has been used in other countries to harness and better manage environmental problems. But the Zambian governance style under the NPM, as this author will show fully, has arguably become narrower and more complicated at the political level. Citizens' demand for goods and services has increased with decreasing resources- a situation that is being experienced at the state and local levels of government. While the private sector has played a big role in terms of advocating for issues such as environmental damage, citizen involvement in decision making through decentralisation is negligible. The public administration has not fully embraced this concept, as it has been difficult and expensive to implement. This author suggests later that coupling decentralisation through proper co-ordination both horizontally and vertically, with pluralist engagement and co-production can lead to a situation where environmental pollution from mining activities can be tackled effectively, efficiently and transparently.

1.5 A brief description of Kabwe

The capital of the Central province, Kabwe, (formerly known as Broken Hill), which is the focus for my research, was founded in the early 1900s when the Broken Hill lead and zinc deposits were discovered. It has a population of 750, 000 people. The Broken Hill mine was for a long time the largest in the country until it was overtaken by larger copper mines in the early 1930s. Apart from lead and zinc, the mine also produced smaller amounts of silver and cadmium. The mine has been closed for almost three decades and the legacy site which occupies 250 hectares is located 1 km south-west of the town centre. Despite its closure, metals are still being extracted from old tailings by residents, due to lack of employment. After the closure of the mines, the town went bust, as the mines were the main employer. A number of economic activities also closed down, leaving the residents in a lot of hardship.
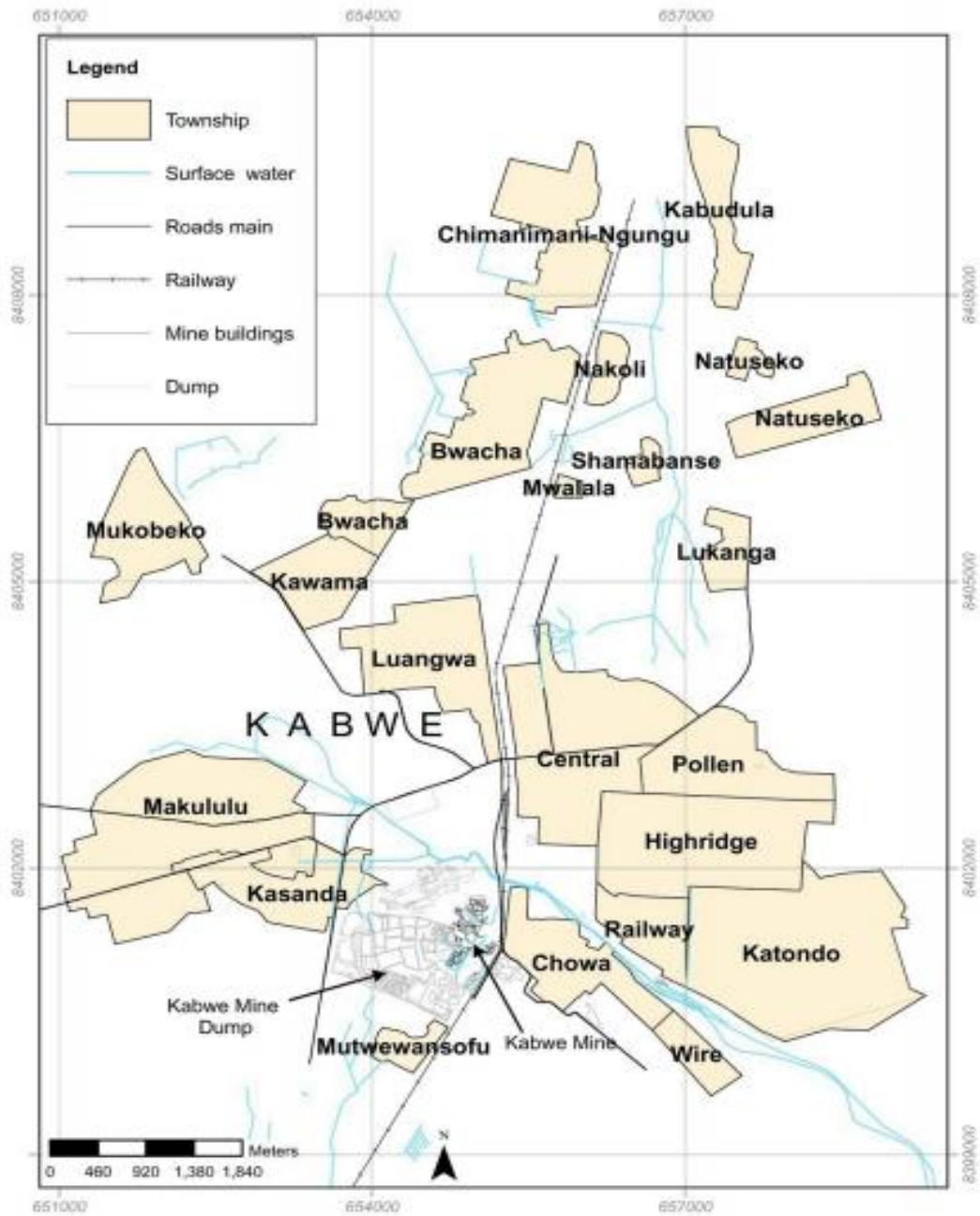
Source: Joseph Makumba/ZCCM-IH.

Figure 1Map of Kabwe

There had been plans to re-open it after the discovery of other minerals.

The major environmental problem lingering from the historical mining activities is serious contamination of soils as a result of smelting and dust emissions from waste dumps. A survey done in 2007 by the Czech Geological Institute, for instance, found that land up to 4 km away from Kabwe in all directions, and at least as far away as 14 km to the west, is unsuitable for agricultural purposes (Czech Geological Survey, 2007). High concentration of lead in soils, consumption of contaminated vegetables, inhalation of lead rich dust and usage of lead polluted water has led to higher concentrations in the blood of citizens living in Kabwe. Hence the reason it was dubbed Africa's most toxic city and the world's fourth most polluted site, according to a survey published by Blacksmith Institute, a New York based organisation monitoring pollution in the developing world.

This is because lead is a potentially harmful substance that affects multiple body systems with serious effects especially to children, who are particularly vulnerable to toxic effects of lead and can suffer severe and permanent health effects which influence the development of the brain and nervous system. When it is inhaled, it can affect the brain, liver, kidney, nervous system as well as the bones (WHO, 2010).

Normal blood levels are less than 10 mg/dl, and levels above are considered unhealthy according to the World Health Organization. In Kabwe, as high concentrations as 300 mg/dl had been recorded in children, and investigations showed average blood levels of children between 60 and 120 mg/dl (www.blacksmithinstitute.org/projects/display/3).

Figure 2 Closed Lead and Zinc mine

1.6 Research Questions

The research problem involves the need to present and clarify the impact of decentralisation in Zambia's public administration as well as its role in helping to curb environmental pollution from the mines.

The problem can be looked at in several dimensions;

- The mining sector policy
- Governance issues
- Environmental policies and condition of communities affected by mining

This study was driven by three research questions:

1) Has decentralisation changed the political, economic and environmental policies as regards the mining sector or is the reverse the case?

2) How has decentralisation been managed as a strategic resource at the national and local level?

3) In view of environmental pollution, are there changes to the way mining is done? If so, what are they?

1.7 Research objectives

The main purpose of the study is to show how issues on environmental pollution from the mines have been decentralised in Zambia's public administration.

The specific objectives are therefore to;

- Conduct a comprehensive analysis of government perceptions on the impact of environmental pollution from mining in the country
- Investigate whether decentralisation has established adequate representation at the local level.
- Provide a dynamic performance management and system dynamics perspective of the problem of decentralisation and pollution from the mines.

1.8 Goal

The study had two goals;

- To show how System Dynamics modeling and Dynamic Performance Management can help policy makers in curbing environmental pollution by applying decentralisation as a policy matter
- To show how to design and adopt Dynamic Performance Management to frame environmental pollution dynamics related to mining.

1.9 Dynamic problem

The dynamic problem is the lack of impact of decentralisation in reducing the levels of mine emissions into the atmosphere from 2001 to 2014. The emissions comprise these pollutants; lead, sulphur dioxide and copper.

Table 1 Pollution levels in Zambia
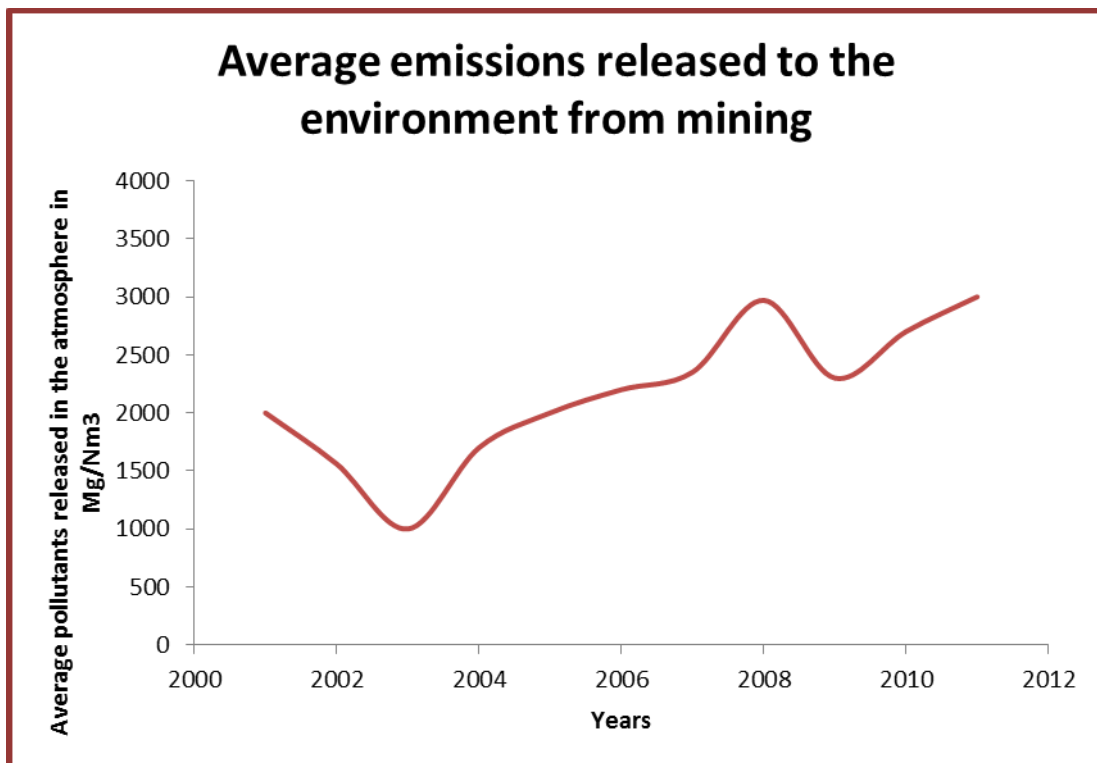
Courtesy of the Zambia Environmental Management Agency

2.0 Hypothesis

The main hypothesis of study is that the development of the decentralisation policy has not been effective to control mine pollution due to the lack of political will. The study is done at

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three levels; mine pollution, impact of pollution, political and administrative decision-making.

2.1 Hypothesised causal relationship

Over the years, not much attention has been paid to environmental issues in Zambia. Environmental issues are deemed elitist, mostly because citizens do not relate poverty or any of their suffering to what is happening in the environment. While there are policies on the environment, they are not enforced due to the non- involvement of the local level in the governance system, and therein lays the problem. As a result, government control on air pollution from mining activities hardly makes any difference to the pollution patterns. This is because the control measures to mining activities are not enforced.

What happens is that more mining increases employment opportunities in the isolated areas, where minerals are found. The more people employed, the more the demand for other goods and services, thereby improving the living standards of the communities surrounding these mines. The higher the demand for locally produced goods and services reduces unemployment and increases the share of workers employed in the services sector, thereby raising average incomes in mining cities. This effect is transmitted into the rural hinterland through increased demand for agricultural products and trade links between urban and rural areas (Lindahl, 2012).

The growth of the mining sector expands urban and rural development and subsequently the population. The pollution from the mining activities equally increases as more demand for the minerals increases the mining done. The mines that are opened in the rural areas encourage inland migration. So in economic terms, as people gain employment, the GDP per capita increases and so does the demand for other goods and services (Allmendinger et al, 2000).

2.2 Scope of Research

The study did not analyse the economics of mining and neither did it focus on the contributions and obligations of mining companies to the communities. Instead, this research aimed at focusing on the environmental risks from mining activities and how decentralisation can help to deal with this.

2.3 Significance of the research

This study was local oriented, focusing on a region where environmental pollution has had a serious effect on the local people. There have not been many studies done on mining pollution and the administrative impacts of decentralisation on the citizens of Zambia. This study is significant for the quality of data that is obtained through field visits and interviews with various stakeholders. The findings of this study bring factual information on the changing socio-political situation at national level and provide inputs for policy recommendation in minimising the impacts of pollution from the mines. The study does not serve as a pro-mining paper or an anti-mining one; instead it tries to take a neutral stand by looking at the impacts of mining activities on the environment and how decentralisation can be used to create a conducive environment for the communities.

2.4 Period of study

The period of study will be from 2001 up to 2014.

2.5 Limitations of this research

This research was based on a particular region in the country where mining activities were a major economic earner. Because of the sensitive nature of such a study, some of the limitations came from government sources who did not want to say much regarding the effects of the pollution on the local citizens for fear of causing uproar among the citizens.

The absence of the Access to Information Act in Zambia was another challenge as there is not much written about this subject and neither is the little information currently there readily available. There was also general lack of literature on governance of environmental issues in Zambia as regards mining activities and pollution effects. The other constraint was the type of methodology employed, in particular System Dynamics, as this is an approach that has never been used before in government policy making. Most of the data was through interviews.

2.6 Structure of the thesis

This research is divided into five chapters. The first chapter is the introduction and lays the background to the research. The second chapter explains the various theories of governance,

policies and pieces of legislation on the environment, as well as management approaches used in the research. The third chapter is the methodology. It centres on the selected research areas, data collection and data analysis techniques. The data is analysed using two main methodologies-System Dynamics and Dynamic Performance Management. The fourth chapter gives a concise summary of the main arguments taken in the research and outlines the implications of these for the policy decisions through a model. The fifth chapter is a discussion of the research according to the findings, which leads to the conclusions in the last chapter. It gives a final analysis of the entire research from the findings as well as the contribution that this study may have made for further research.

Chapter Summary

This chapter has explained the reasons for this research. Economic development is the cornerstone of any government. Public policy, on the other hand, shapes the development of any economic and social agenda. Many years of mining in Zambia have left negative impact to the environment, a situation which has been left unattended to by policy makers. One of the reasons that can be attributed to this is that issues of the environment have not been taken seriously both by the government and also by the citizens. There is also a serious lack of information, thereby making the case for environmental pollution seem negligible.

The main reason for embarking on this research was not only to create awareness but to show that governance models can work in reducing pollution levels.

CHAPTER TWO   LITERATURE REVIEW

2.0 Introduction

This chapter sets the background for the research by looking at the literature available on environmental pollution from mining activities in Zambia, followed by the legislation and policies that currently speak to it. Pollution from mining has been a matter of concern the world over, with debates on the environment now taking centre stage. In Zambia, mining has occurred as far back as the early 1900s, but concern over its impact on the environment has only been shown during the last decade, when different policies and pieces of legislation became effective.

From the public sector perspective, handling of environmental concerns wherewithal requires putting in place management practices that are not only workable and mature, but also understood and accepted by all stakeholders alike.

Public governance has been besotted by various forms and models of governance. For a start, the concept of public management itself has been re-constituted due to the differing needs of societies all over the world. These concepts emanated from the Western democracies, which were characterised by strong states and well organised civil societies (Osborne, 2006), and later trickled down to developing countries, which in most, if not all cases, have greater challenges in adopting these concepts.

With regard to the government of environmental issues, it would be safe to state that there are no well-designed structures in place to deal with them. As can be pointed out by Halimi and Shinn (2014:181), past efforts to mitigate the effects of environmental problems have not always been adequate to address the embedded content in policy and administrative structures that have been designed to address conflicts that are technical in nature. A number of stakeholders and practitioners alike are becoming aware that solutions to these matters require action on both a large geographic scale and local level, which can be driven by political will and large-scale governance structures.

Matters of pollution from mining in this instance deal with large-scale programmes and the conflict comes when deciding how to govern at and across the various levels. For Cash et al. 2006; Lemos and Agrawal, 2006, a multilevel approach, or MultiLevel Environmental Governance (MLEG), is much better suited to solving complex environmental problems. According to the Organisation for Economic Co-operation and Development (OECD 2011), multilevel governance is defined as the explicit or implicit sharing of policymaking authority, responsibility, development, and implementation at different administrative and territorial levels such as (1) across different ministries and public agencies at the central government level; (2) between different layers of government at local, regional, provincial/state, national, and supranational levels; and (3) across different actors at the subnational level.

The unbundling of the various levels of governance in dealing with environmental problems presents a particular challenge when it comes to where the authority lies (Christensen et.al, 2014). For instance, in the study of pollution from mining activities in Zambia, authority is centred across established core constitutional institutions such as the Ministry of Mines and Ministry of Land, Natural Resources and Environmental Protection, which controls all policy related to mining and the environment. At the other level are the public/private partnerships, where there is a mixture of state and non-state actors, such as the civil society organisations vested in dealing with environmental matters.

So in essence, the governance of environmental issues at the various levels raises questions of what constitutes the linkages. For Peters and Pierre, (2004), the institutions between the different levels of governance are the most important. The author will lean more towards this view as the absence of institutions or a set of rules has exacerbated the problem of environmental problems both globally and nationally. Further, with these institutions in place, enforcement should be applied in governing the interactions at the various levels.

2.1 Mining emissions and mine pollution in Zambia

Zambia's economy relies heavily on mining. The industry contributes about 6.2 per cent of GDP to Zambia's total economy, therefore being the major economic earner. It also made revenue contributions of 0.7 per cent of GDP from 2001 to 2005, and 3 per cent, in 2010. As a result, government realised a lot of revenues from mining. Despite the fluctuations in

copper prices on the world market, copper production tripled from about 250, 000 tonnes in 2000 to 750, 000 tonnes in 2013 (IMF, 2015). It also accounts for 0.1 per cent of government revenue.

Most of the mining is done in isolated areas. These are open areas with low settled population densities in which the high proportion of the unsettled land area is used mainly for primary production such as mining, agriculture and forestry. The residents are also highly dependent on these primary production activities. Mineral exploration is also driven by world market demands. While the prices of copper fluctuate, it still remains Zambia's major foreign exchange earner. Most mining is done on the Copperbelt province and North Western provinces. The major minerals mined are copper, magnesium, cadmium, lead and Zinc (Banda, 2012).

Mineral dressing processes produce effluent, tailing dumps and ponds which take up very large land surfaces (Twerefou, 2009). Due to Zambia's long history as a mining nation, there are many historical legacy sites that cause environmental problems. In many historical mining areas, there are now new operations which make it hard to distinguish between historical and current impacts of mining. The mining industry has accumulated about 32 overburden dumps containing about 1,899 million metric tonnes of overburden, which covers an area of 206, 465 hectares. This includes about 21 waste rock dumps which covers 77 million metric tonnes of rocks on an area of about 388 hectares. Add to this, 791 million metric tons of tailings are to be found in 45 dams on an area approximately 9,125 hectares, (Sikaundi, 2008).

Since 2001, most of the previously state-owned and unprofitable copper mines have been revived through extensive investments by new owners. As the mining operations are scaling up production to make profits on the invested capital, the concern for the environment is prone to be overlooked (Lindahl, 2012).

Mining industries have been known to contribute greatly to pollution from heavy metals. In China, for instance, which is the largest producer and consumer of lead and zinc, there has been a lot of harm on the environment of which some of the impacts centre on the soils and vegetation. Lead and cadmium are the main pollutants (Cernak, 2006). According to the

Auditor General's report (2014), Zambia was well above the limits stipulated by the WHO in terms of mining emissions. With a legalised limit of 50mg/Nm3, the air pollution instead ranged from 157.1mg/Nm3 to 2, 679.5mg/Nm3 between 2009 and 2011.

According to Zambia's State of the Environment report (2008), there has been an upward trend to the emissions especially of sulphur dioxide in the atmosphere as a result of increased investments in the mining sector. This is especially evident in Mufulira, a town situated on the Copperbelt province. The standard for sulphur dioxide (SO2) levels ambient in the air for the mines is 500Mg/m3 per annual average which is higher than the regulated 80Mg/m3 from the WHO. This is the most common way of measuring pollution in the atmosphere. The other pollutants are oxides of nitrogen (NO2), particulate matter, carbon monoxide (CO), dust and carbon dioxide (CO2).

Table 2 Air emissions for Zambian minerals

Pollutant	Concentration (in Mg/Nm3)
Sulphur dioxide	1000
Arsenic	0.5
Cadmium	0.05
Copper	1.0
Lead	0.2
Mercury	0.05
Particulate Matter	50

Table 2   Air emission requirements for Zambia

Source: The Air Pollution (Licensing and Emission Standards) Regulations, 1996

2.2 Sustainable development

The term "sustainable development" was first introduced in 1987 at the World Commission on Environment and Development (WCED) in order to discuss the conflicts between environmental and developmental goals. It came about after the realisation that there were challenges being faced in the environment as a result of uneven development, overconsumption and poverty. Hence sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs (World Commission on Environment and Development 1987:8). What this centres on is the careful use of resources so that they are not depleted for future generations. However, scholars and institutions dealing with environmental issues argue that for sustainability of the environment to actually take place, poverty must first be tackled (Hodder, 2005). Perhaps a look at the developing world and the indiscriminate use of natural resources such as the cutting down of trees for charcoal begs the view that tackling poverty first could indeed help to bring about sustainability of the environment.

2.3 Environmental impacts of active mining

There are a number of implications on the environment to mining activities, such as land, water, air and the forest. These subsequently have negative impacts on the livelihood and social structure of mining communities.

2.3.0 Air pollution

In Zambia's Copperbelt province, the mining industry (mostly the copper smelters) contributes to over 98% of the country's Sulphur dioxide (SO2) emissions. In the early 2000s, the total SO2 emission was 346 700 ton/year (Environmental Council of Zambia, 2008). Recent investments in mining activities are expected to yield increased SO2 emissions because of several new copper smelters. It goes without saying that high SO2 concentrations will directly affect the health of both humans and biota. Oxides of sulphur (SO2) can irritate respiratory passages and aggravate asthma, emphysema and bronchitis. Environmental pollution by chemicals such as SO2 as well as metal deposits from lead and zinc are harmful to humans and the ecosystem (Alloway and Ayres 1997; Ncube et al., 2012).

Data on toxology shows that humans have fatalities that can arise from short-term exposure to atmospheric sulphur dioxide (SO2). This pollutant unfortunately has no technology that

can be used to recover it from the atmosphere. The Copperbelt region of Zambia releases atmospheric emissions of between 300, 000 and 700,000 tons/year from copper smelting activities. According to the World Health Organisation, the acceptable levels are 125 000 tons/year (WHO, 2012). It was interesting to note that emissions are reducing in areas with new mines because these have machines that are able to regulate the emissions. Unfortunately, the story is different with the older mines which have out-dated machinery that cannot regulate the emissions.

In Kabwe, where lead mining began almost a century ago, levels of pollution from lead are still eminent. With a standard emission rate of only 0.2Mg/Nm3, the pollution exceeds this by as much as 25.9Mg/Nm3.

2.3.1 Soil contamination

Accumulation of metals in soil is a result of wind-borne dust particles (from dry tailing dams) and particle fall-out from smelters. The main soil contaminants that occur in concentrations high enough to constitute a significant hazard to human health, are copper and cobalt (SGAB et al. 2005).

2.4 ENVIRONMENTAL LEGISLATION IN ZAMBIA

Zambia underwent a major policy change with the introduction of multi-Party politics in 1991. The ushering in of the Movement for Multi-party democracy (MMD) reversed many of the socialist policies of the one party second republic and set about liberalising the economy. One area where this was felt significantly was the privatisation of the mining sector, which has been Zambia's major foreign exchange earner since independence. Consequently, it was uncertain how privatisation would impact on environmental management, given the economic pressures under which companies operated. It was hoped that privatisation would lead to the acquisition of newer and cleaner technology capable of meeting higher environmental standards, since most technology were out-dated and incapable of meeting acceptable environmental standards (UNEP, 2011).

Policies relating to mining under the structural adjustment in the 1980s put less emphasis on addressing environmental degradation caused by mining activities (Makumba, 2007) as seen from the time legislation and policy were properly put into place. Besides the lack of

awareness on the effects of mining activities, most developing countries tended to focus on the economic gains and would therefore rather not put an additional cost to investors in order not to discourage them since pollution abatement could become an added cost to them (Twerefou, 2009). Although the first action on the environment was the 1985 National Conservation Strategy policy document, which identified key environmental problems that needed to be tackled, among them pollution, it was recommended that there was need for legislation to tackle problems of pollution ; create an environmental council; create a programme to build environmental assessment and planning capabilities within key environmental and resource management institutions, including the integration of environmental economics into economic planning process in the National Commission for Development and planning (NCDP), (IUCN, 2007).

In the case for decentralisation and co-ordination, the NCDP had Provincial Planning Units in all the provinces (PPUs) which were responsible for all provincial and district development planning. These were also necessary to providing environmental planning and assessment training.

2.4.0 The Environmental Protection and Pollution Control Act of No. 12 of 1990

The Environmental Protection and Pollution Control Act (EPPCA) No.12 of 1990 Cap 204 established the Environmental Council of Zambia (ECZ). The EPPCA came to be enforced after the introduction of multi-party politics that saw the emergence of Frederick Chiluba as President. This was a new regime which stood on the capitalist principles of development. There was now a deliberate effort under this regime to enact new environmental laws to safeguard economic liberalisation while safeguarding against potentially negative environmental consequences. The ECZ was then a new national regulatory body responsible for enforcing environmental regulation and co-ordination of the different sectors of government agencies involved in environmental management. The EPPCA was also responsible for setting environmental standards. For instance, it required that all effluents and emissions from mining operations were regulated through a system of permits, licenses and fines. Dumps and tailing dams were also regulated.

In 1994, the National Environmental Action Plan (NEAP) was developed to provide the overarching environmental policy new legislation. The NEAP had replaced the 1985 National Conservation Strategy, which had previously provided guidance on all environmental policy issues. A number of environmental protection laws were thus enacted and integrated with a range of statutory instruments and international conventions.

2.4.1 The Mines and Minerals Act of 2008

This legislation regulates activities relating to mines and minerals development operations including quarrying and provides for regulations for environmental protection during prospecting, processing activities and construction of the mine area.

The Act also addresses the environmental, health and safety aspects of the mining licenses delivered by the Mines and Minerals department within the Ministry of Mines.

Within the mines ministry, the Mines and Safety department is a delegated authorising body which has the powers to issue mining licenses. This department has a wider mandate and has been in existence for some time now. It helps in retrieving environmental impact assessments; negotiate for environmental management plans and issues licenses in compliance with environmental standards during the time when environmental management was not considered an issue. Initially, there was weak co-ordination between this department and the ECZ then.

At the time of privatisation, the problem of mature environmental liability of the Zambia Consolidated Copper Mines (ZCCM) and smelters was passed on to the government, as the opinion was that new owners should not take on responsibility for damage which they were not responsible for (Mukandala, 1995; Kabwe, 2001). The development agreements between the mines and government confirm this, besides also exempting the mining companies from any liabilities related to any past activities of the ZCCM. The agreements actually allowed for delayed compliance with the provisions of the environmental plans done by ZCCM and environmental regulations. This means that the role of ZEMA has therefore been limited as the owner may choose to refer a non- compliance dispute to a nominated expert (Draisma, 1998).

The Act also talks about the development agreements which were done after the repeal of the Mines and Minerals Act of 2005. These have been difficult to abide by because the legislation in the 2005 Act gave mining companies a lee way into doing what they wanted after obtaining licences to mine. So when the Act was amended in 2008, the previous inclusions did not go away simply because of the way the pieces of legislation were drafted. The agreements were such that mining companies could not be held accountable for the pollution that was left behind after the mine was closed. Government instead said it would take up this responsibility and this was done as a way of attracting investors into this sector. Inevitably, there have been consequences of this loose part of the legislation.

2.4.2 The Environmental Management Act No. 12 of 2011

The governmental framework that regulates the mining sectors' environmental compliance is centred on the Environment Management Act (EMA) of Zambia. This is the principle law on the environment in the country. It takes precedence over all the other pieces of legislation in the country. This act replaced and repealed the Environmental Protection and Pollution Control act cap 204 of 1990. It discontinued the existence of the Environmental Council of Zambia, and renamed it the Zambia Environmental Management Agency. On paper, it is a comprehensive piece of legislation on the environment in that emerging issues such as the inclusion of environmental management, provision for the declaration of protected areas as well as the provision for fines to polluters are covered in this new piece of legislation. Most notable is that it provides for an integrated environmental management, prevention and control of environmental pollution and degradation, as well as calling for public participation in the decisions concerning the environment. The EMA is given powers to take to task anyone mining development that poses a risk to the natural environment.

Perhaps the novelty about this Act is the precautionary principle, which allows the Minister in charge of the environment to make new environmental regulations through a statutory instrument.

2.4.3 The Local Government Act cap. 28

This Act was enacted and implemented in 1991 and provides for the establishment of councils or districts, the functions of local authorities and the local government system. Some of these functions relate to pollution control and the protection of the environment in general.

It provides for an integrated three tier governance system where the functions of local authorities are clearly spelt out, among other things. It was preceded by the Local Government (Amendment) Act of 2014, which sought to establish the Local Government Equalisation Fund. This fund is meant to supplement the financing of the councils for the performance of various functions. It means that each council has the authority to make its own revenues.

2.4.4 The Constitution of Zambia

A constitution is the supreme law of the land. The revised constitution 2015 puts emphasis on the environment and has three clauses tackling matters of the environment; Articles 255, 256, and 257. In a nutshell, the focus is on the protection and preservation of the environment. In particular, it offers penalties for anyone causing damage to the environment through pollution.

Principle (b) of Clause 255 states;

"The person responsible for polluting and degrading the environment is responsible for paying damage to the environment".

2.5 POLICY

The top down approach to decision making assumes that the policy process can be viewed as a series of chains and commands made by political leaders and articulated in a clear policy reference which is then carried out by the administrative machinery that serves the government (Dunleavy, 1985). Zambia has developed policy that helps to improve programme implementation in line with the environment as well as its governance system in general.

2.5.0 The National Policy on the Environment

Zambia's national policy on the environment was officially launched in 2007. This is the principal policy that co-ordinates environmental management in Zambia. It was designed to create a comprehensive framework for effective natural resource utilisation and environmental conservation which will be sensitive to the demands of sustainable development (National Policy on the Environment, 2007). The policy was centred on the decentralisation of the country's environmental management. It means all organisations and individuals should exercise care to ensure there is unnecessary depletion in the natural assets

of the country. By itself, this policy is comprehensive in dealing with the various aspects related to the environment. Notable among them is the need to regulate and enforce environmental law. It is aimed at facilitating integration, decentralisation, community participation, privatisation and further development.

2.5.1 The National Decentralisation Policy

Decentralisation has been a feature of Zambia's governance system from as far back as independence in 1964. It can be categorised in phases because of the level at which it had been implemented and appreciated under the different regimes. Hence, phase one is from 1964 to 1970, which was the post-independence period. Phase two is from 1971 to 1979, which was more of a confirmation of a one party style of governance. Phase three was from 1980 to 1990, and phase four, the most critical period for Zambia's democracy, was from 1990 to 2000. This is the period that saw the re-introduction of multi-party politics. The last phase is therefore from 2000 to date.

It must be stated that the first major move towards decentralisation reforms was in 2002, as this is when a national decentralisation policy was developed. This policy span for ten years and was reviewed in 2013, mostly to pave way for the inclusion of the ideals of the new Patriotic Front (PF) government. The form of decentralisation favoured is devolution, which is where the central government creates or strengthens the lower levels of government, thereby lessening the direct control of the central government (Mukandala, 1995).

When it comes to matters of the environment and sustainability, the economic instruments such as pollution taxes and capacity building can only operate best under a decentralised system. It is safe to state, therefore, that in order to implement any approaches towards environmental matters requires a well-functioning set of political institutions, which work best under a decentralised system.

2.6 Theories of Governance

The literature by itself offers myriad definitions of what governance is. As a start and as part of this discussion, "public governance" or simply "governance" is part of what public administration does. To give further insight to this theory, a number of characteristics warrant further observation. The first argument is that Public governance is about governments

promoting the greater good (Robinson, 2014). It is more than just improving efficiency, effectiveness and accountability because a government must be one that citizens can also trust. The second argument emphasises public governance as that which brings about the implementation of government processes that are not only capable of being implemented but are in agreement among the various stakeholders. This particular characteristic places a lot of emphasis on the role of stakeholders in governance issues. It places politics at the centre of everything (Yang and Holzer, 2006; Sanger, 2008; Morgan and Shinn, 2014). It is the latter argument that this research is inclined with by looking at the role of stakeholders and government in decentralisation and pollution control.

Public governance, it has been observed, pays a lot of attention to the interactions between all the levels in an organisation and ensures that both the citizens and stakeholders alike are satisfied with the outcomes (Bovaird and Loffler, 2003). One would therefore say there is a relationship between public management and public governance because they both tend to want to reduce the size, scope, costs and inefficiencies of government.

The governance theory, it has been pointed out, looks similar to traditional public administration theories, and therefore emphasis is on the inclusion of a wide range of stakeholders in government and the resulting complexity of relationships between such stakeholders. Public governance in the final analysis is viewed as a co-production process that involves the public, private market and non-profit sectors for the creation of public goods. In this role, government is seen to be a catalyst to investing in private and non-profit stakeholders in the shared ownership of public goods (Morgan and Shinn, 2014:6).

2.6.0 Public Management Theory- the New Public Management

The understanding of public management begins first with the definition of public. Generally speaking, "public" are groups of people who inhabit the public domain. This is a simple definition that gives a broad but inclusive idea to the various groups found in the public.

Hence, public management is the management of public organisations. It is known as an evolution of public administration which applies managerial techniques to effective and efficient service delivery (Hood, 1995), or for some scholars, an approach which uses

managerial techniques (borrowed from the private sector) to increase the value for money achieved by public services (Bovaird and Loffler, 2003).

But public management has gone through a number of reforms over the years, all evolving around participatory and networked processes which culminate into an effective and efficient public service. The New Public Management style reforms centre on bringing the management techniques of the private sector into the public sector (Hood, 1995). It has also become a focus for both developed and developing countries, as a managerial thought (Ferlie et al.,1996:9) or based on the need for a public sector that focuses on efficiency, structural revolution, decentralisation, competition, management principles and increased use of contracts (Christensen and Laegreid, 2007). In market economies, it is accepted that government alone cannot achieve their objectives through their administrative machinery but through markets and the community. It is about running government as a business, as others would say (Morgan and Shinn, 2014), though this is subject to a number of criticism and objection, as it is felt that government should be much more than this since it is responsible, too, for the normal values that make up communities (Kelly 1998; Lynn 1998). The NPM is also a normative issue based on two premises; on the one hand is the need for more autonomy whilst at the same time advocating for central control. Hence, it has been known as a "double edged sword" by its critics (Aucoin, 1990).

It also gives emphasis to the accountability by managers to secure the required levels of management performance (Aucoin & Heintzman, 2000). For developing countries such as Zambia, the most indelible reason for public management reforms centred on the budget deficits and the increasing public debt. This was a precursor for international organisations such as the World Bank (WB) and International Monetary Fund (IMF) introducing reform programmes by withholding aid funds for a number of projects and programmes. Accountability also became an issue where most programmes where equally tied to intense monitoring by the donors. This ensured that the government became not just responsive to the needs of the people, but compelled it to provide improved quality of service.

As has been pointed out, there are variations to how reforms are practiced from country to country as they face different internal and external constraints, risks and starting points. Larbi, (1999) points out that NPM needs to be adopted creatively and realistically other than

following the blueprints that are not implementable. Christensen and Laegreid (2001), argue that the NPM has resulted in is a fragmented public sector, in the sense that there has been increased vertical and horizontal specialisation. In Zambia, for instance, which favours a western- style parliamentarian system, the NPM reforms became a major part of the civil service reform programmes, which were also a part of conditions set down by the World Bank to allow it to achieve certain targets. In addition, the constitution, which is the main law of the land, has been going through a series of reviews, a situation which has seemingly dragged due to the constant change in government. Therefore, it is best to state that reforms such as these require a right strategy in place and that they are driven by visionary leaders (World Bank, 1997).

The major issue revolves around policy making and service delivery, which are peculiar problems within public administration. This may prove a bit tricky as not all policies are centred on all citizens, while service delivery can also pose as a serious challenge. Pollitt (2003b) says that the idea behind horizontal and vertical co-ordination was to create a situation where policies could be accepted at all levels of government without undermining each other, where the scarce resources such as water, for example, in some developing countries, could be made available to all and where there are synergies created with stakeholders for various policy areas, while offering citizens access to better service delivery.

But one of the major challenges within the NPM has been that of co-ordination, which can be implemented vertically or horizontally. This is one area where issues of decentralisation, as we shall see later, now come into play. One explanation from the instrumental hierarchical view is that under vertical specialisation, the focus is more about giving autonomy to both regulatory and government agencies, and this is where devolution or decentralisation come in. Horizontal specialisation, on the other hand, requires that the roles and functions of government are clearly spelt out.

The NPM has been criticised for leading to corruption between policy makers and heads of bureaucratic institutions (Schick, 1996). While this may be the case in certain instances, it still has not deterred a number of countries especially in the developing world in adopting it. One of the other critics is that it limits the responsibilities of the public sector and undermines values and the collective interests (Agrawal and Ostrom, 2001).

Public management should instead be an inclusion of both being a business while at the same time responding to the needs of the communities at large. It can also have autonomy on the one hand but have central authority especially on the issues that are at a national level or are of national importance such as security and indeed the environment. What matters is how decentralisation is implemented.

What can be concluded about the NPM is that it needs to be made holistic and people friendly. While the dominant form of rationality is that of management, it however may not sit well with politics and thereby creating conflict between politics and public administration. It is observed from various studies therefore that there is no consistent theoretical or ideological framework that actually supports NPM.

And while the NPM has tended to focus on economics, i.e., the efficiency and effectiveness of the public sector, another concept called "Whole-of-Government" emerged, whose sole task is to embrace other forms of co-ordination from insights within the social sciences such as law (Mulgan, 2005, Bianchi, 2010). What seemed interesting about this were the better usage of policies as well as creation of better synergies with various stakeholders to allow citizens to have better access of the public services (Politt, 2001).

2.6.1 Decentralisation

Decentralisation is one clear means by which the tasks of integration (trade-offs) between otherwise distinct sectoral issues can be made. It was one of the influential procedures for managing efficiency that were used for public sector reforms for many decades (Loffler, 2003). Having first developed in the first world countries, decentralisation was seen as an answer to the dissatisfaction of the public due to inefficiency and ineffectiveness of the service delivery. Factors such as level of development, inequality and ability of citizens to participate in politics are intervening aspects that determine how public services are distributed (Gibson and Hoffman (2005:5). Because of the different contexts with which decentralisation has come to be known by, it is necessary to provide some definitions.

The basic concept about decentralisation is the transfer of authority or power from the central government to the lower levels, namely the local council or municipality. It can be at the

political level or administrative level. In further analysis, decentralisation may mean the transfer of functions performed at the central level to the lower levels while power and authority are still maintained at the central level, also known as de-concentration (Manor, 1999). In this form of decentralisation, accountability is left to the centre and popular participation may not be realised. It can also mean the devolution of some powers and authority from the centre to the lower levels. This type of power distribution is usually done at the political level and is backed legally such as by the constitution. For instance, government can decide to transfer certain powers and authority from the central government to local authorities. In Zambia, where functions and resources are transferred to democratically elected sub national authorities that are representative of and downwardly accountable to local populations, devolution takes a deeper form where it is referred to as political or democratic decentralisation. It is this form of decentralisation that has been favoured in the governance system of the country.

Polidano (1999) gives an interesting perspective of decentralisation and makes the basis for the theories around it. He first differentiates between the political realms with the administrative realm. Political or democratic decentralisation aims at increasing public participation in local decision making. It is a major discourse of discussion especially in Africa as local governments suffer from the same or even worse constraints as the central government. That explains why it is seen as an important part of reforms by the central government because it implies a huge transfer of civil servants to local authorities as well as a radical restructuring of institutions and ministries (Crook and Manor 1998). It is also an institutionalized form of the participatory approach where representatives are able to make decisions on behalf of local populations, such as using public local resources for investment in whatever the local population needs and desires. Democratic decentralization is considered stronger and the one from which theory indicates the greatest benefits can be derived (Ribot 2004: 9).

Decentralisation in this research follows the form of devolution, since the transfer of the power and resources is within political structures and in institutionalised through some legal backing such as the constitution (National Decentralisation Policy, 2013)

Administrative decentralisation or de-concentration aims at the transfer of power from the central government to the lower levels such as councils and local administrators which are appointed as local administrative agents of the state. Its primary responsibility is to the state or central government as power still remains at this level. It is however considered the weaker form of decentralisation because downward accountability is not well established as is the case with democratic decentralisation (Ribot 2004:9).

Decentralised governance is still being favoured by many African countries as the most suitable form of governance, through which poverty can be tackled using interventions such as planning, implementing, monitoring and evaluating (UNRISD, 2008). It is for this reason that decentralisation has been explained as an outcome of pressure from economic crises (Therkildsen 2001:1; Shergold, 2005), a means for central governments to shed fiscal and administrative burdens (Ncube 2012), a failure of central administration (Schick, 1996); an emulation of reforms in other developing countries (Therkildsen p.1); a result of populist political success (Heller 1996), a result of donor pressures and conditions as part of structural adjustment and other programmes imposed from the outside (World Bank 2000; Mutizwa-Mangiza 2000:24; Therkildsen p.1), as a response to sub national splinter groups and pressure to appease and incorporate local elites, and as the consequence of particular relations between central and local levels (Crook and Sverrisson, 2002).

Decentralisation in general brings about two sets of results; social effects, which include things such as poverty alleviation and participation, and ecological effects. Crook and Sverrison, (2002), for instance, argue that there is no predictable link between decentralisation and pro poor outcomes such as poverty alleviation.

In theory, decentralization should improve resource allocation, efficiency, accountability, and equity "by linking the costs and benefits of public services more closely" (Polidano, 1999:98). Local governments know the needs and desires of their constituents better than national governments, and at the same time, it is easier to hold local leaders accountable. Decentralization is also about promoting democracy by "bringing the state closer to the people," increasing local participation, and building social capital. It has also been purported to improve sustainability.

Natural resources, however, have political and economic dimensions beyond those of other sectors, such as health and education, which increase the level of conflict and resistance to decentralization policies (Agrawal and Ostrom, 2001). It is with this perspective that matters of environmental pollution from mining fall.

However, the concept of decentralisation is not without its critics. For a start, it has been said to bring about contradictions within the NPM for raising questions about accountability, control and capacity. At the horizontal level, co-ordination has been a challenge within ministries while at the vertical level it is a challenge across inter-sectors. The devolution of financial services closer to the point of delivery, for instance, gives more independence to the people at the local level but the need for co-ordination, allocation of resources, establishment of strategic framework and resolution of conflicts can mean that these matters are centralised (Christensen and Laegreid, 2001c; Hood, 2001).

This, therefore, creates what Walsh (1995:203) terms, "an erosion of the influence of the intermediary tiers of government, notably the local authority". What this brings out is that, in a way, decentralisation can create the need for centralisation, especially when it comes to dealing with critical issues such as resources- both in terms of money or natural resources. The conundrum comes in though when we want to see how autonomy can be maximised while ensuring that both the centre and the local level have their interests met. It is difficult to solve many societal problems, such as this particular one dealing with pollution from the mines, using one specialised organisation. It therefore has the capacity to undermine political control and consequently bring about a disconnected system.

Decentralisation has also been criticised for eliminating values such as fairness, equality and honesty (Fatemi and Behmarlesh, 2012). This can lead to aspects of corruption, no doubt, which will border mostly on political forces (Hood 1991). By this is meant that since the public sector cannot operate without the political control, it is imperative that policies and internal management systems will be affected.

However, there is a problem when state control is forced to extend over the local people, when concerns over equity are not properly addressed and also when those receiving powers are not accountable to the local people (Brunson 1993:32). Of all the benefits therefore of

decentralisation, the ones that the research is most concerned with include those related to governance; responsiveness, accountability, co-ordination and political participation.

We have to be mindful though, that, when the local actors are not clearly known, there has been conflict. This was the case in Zimbabwe, for instance, over a wildlife management project. The lack of participation of the local actors led to conflict over decentralized resources, such as revenues, increased tribal tension and confusion regarding the role of the different institutions that were working in a particular region (Dunleavy, 2010).

Agrawal & Ostrom (2010:78) argue that "decentralization has occurred only when governments devolve property rights over resources that conform to the collective and constitutional choice levels," rather than just operational level decisions, to local users. Collective choice decisions refer to defining the operational rules, and constitutional choice decisions determine collective choice situations. Constitutional choice decisions are those that determine who has the authority for making these rules. Evidently, there is need to have decentralisation clearly stated in a country's main framework such as the constitution (Polidano, 1999), since this is where power is centralised and the rule of law imposed as it demands adherence to how people want to be governed. In this way, it is easier to challenge certain decisions which might not seem favourable to its citizens.

2.6.2 Dynamic Performance Management

It has been pointed out that the public sector is a complex and dynamic system. This can be seen from the number of institutions and other competencies that are marked by the different inter-related domains, such as municipalities, NGOs, government departments, public agencies (Bianchi, 2010). Performance in the public sector has a huge impact on the quality of life of the people. In fact, this is what the public sector strives at; ensuring that products and services are equally and efficiently distributed to those they are intended for. It may also constitute what Bianchi and Rivenbark (2012:376) have termed, "an acceleration factor or a constraint for the growth of the socio-economic sectors".

There are three major levels that comprise public administration; macro, which is more focused on the politics, micro, which is managerial and meso, where both managerial and political converge. An issue or problem such as environmental pollution from the mines will

imply that "the political decision maker takes an active role in the wider system where his institution such as a state or region operates in order to undertake a strategic conversation with other players in other institutions, such as a municipality, to establish joined-up government initiatives"(Bianchi 2010:378). The reverse would undoubtedly create confusion and some form of "administrative anarchy".

The second generation reforms of the 1990s recognised that alternative strategies had to be realised to improving efficiency and effectiveness of the civil service by not only focusing on better pay determined by job evaluation and internal relativities but towards the alignment with relevant labor market rates within the country (Stevens and Teggemann, 2004). So mangers were given greater freedom from central government to achieve specific standards and targets. Another major feature of these reforms was the move away from centralisation of activities to pushing public service delivery to the local level. As is the case for Zambia, this has been tied to the quest for improving efficiency. Strategic plans as well as annual work plans are a strong feature of the new management.

That being the case, environmental governance is a complex arena in Zambia, which is compounded by a fragmented and evolving legislative framework as well as a lack of clear guidelines on the division of roles and responsibilities across the three spheres of government. Evidently, local government plays an important role in matters of environmental governance, although this is often not acknowledged. The pressure to deliver vital services as well as enhancing opportunities for development at the local level may be seen as conflicting with matters of the environment. As a result, the environment is regarded as complex, confusing and a low priority area at the local government level, thereby making the performance of a number of municipalities poor.

2.6.3 New Public Governance

The reverse of NPM is what is termed New Public Governance. In it are a cluster of principles such as coordination, participation and co-production which are the main focus and the opposite of what is found in NPM. The NPG states that for public service delivery and policy formulation to be improved, there should be more cooperation, negotiation, and the active participation of relevant stakeholders who are expected to come in with their

knowledge, ideas and financial resources (Brunsson, 1993). In addition, NPG regards public employees as being both selfish and altruistic (Armah, 2010) while participation is seen as a driver of democratisation (Brunsson, 1993). This rings true for both management approaches and can be attested to even in developing countries like Zambia where political systems have become more inclusive and participatory

Some have stated that NPM has transformed itself into NPG (Osborne, 2006). The narrative is that there has been a shift away from the primary focus on results and efficiency toward the achievement of broader governmental goal of creating value in the public by putting an emphasis on politics. NPG is rooted firmly within organisational sociology and network theory. An important indicator of the NPG is the preparation of public policy. New public governance raises new requirements for implementation of social responsibility. Modern consideration of governance first of all is connected with quality changes of governance. However, the analysis on the implementation of the new public management doctrine reveals that there are dysfunctions of this public governance pharmacy, the biggest part of which is related one or the other way to social aims of society and problems when analysing them (Bovaird, 2006).

And because this new model of governance remains conceptually underdeveloped, more so for developing countries such as Zambia, it does not become the focus in this research.

Chapter summary

This chapter began by taking a look at the environmental, legislative and governance issues in Zambia. Even though mining has been an economic earner for the country for a long time, the legislation only came into place much later. The legislation is strongly backed by the governance system in place.

The governance concepts were looked at in general, with a particular focus on such as the New Public Management (NPM), which is a neo-liberal policy meant to improve public sector performance and efficiency using private sector techniques. A newer form of governance called the New Public Governance (NPG) was also discussed, while focussing

mostly on decentralisation, which is a management style favoured within the new public management.

The concepts in governance showed that they emanated from the western democracies before being adopted in developing countries. The NPM in particular was reviewed and the advantages and disadvantages of this form of governance were brought out. A newer concept, the New Public Governance, was also discussed, even though it is yet to be inducted into the Zambian public administration. One of the elements from the NPM that has been adopted in the developing world is decentralisation. This concept brought out the different arguments from various schools of thoughts. The decentralisation discourse in this research is looked at from mostly an administrative context. While the governance reforms have been taking root globally, some of them do not quite appeal to the nature and character of certain developing countries, therefore rendering them only as normative. However, there are still a number of benefits that can be pointed out, exclusively that of efficiency, accountability and participation.

CHAPTER 3   METHODOLOGY

3.0 Introduction

This research was conducted using two main methodologies; System Dynamics and Dynamic Performance Management. This chapter explains these methodologies and includes an explanation of the rationale for the selected approach, the process of data collection and analysis and generally how the research framework was constructed. The main objective for the research was to find out how the Public administration in Zambia can use a Dynamic Management Approach to assess how decentralisation policies may reduce environmental pollution from mines. Principally, the research used qualitative methods even though at the end, the analysis culminated into quantitative data through the development of a model, using System Dynamics as a methodology. A description of both methodologies is given in order to clearly understand why one of them was preferred against the other, in looking at the problem under study. The chapter also presents a methodological framework.

In order to generate theory from the data obtained, the grounded theory approach was used. Grounded theory, according to Strauss and Corbin (1990), Punch (2001), and Glaser and Strauss (1967) is a research strategy aimed at generating theory from data. It helped with the proper analysis of data and enabled this author to come up with a systematic way of looking at a problem. In a grounded theory approach, the theory emerges from the data inductively, meaning it has context, processes and evidence (Mansourian 2006:397).

3.1 Research paradigm

This research was mostly qualitative. This is because this methodology can help a researcher approach fieldwork without the constraint of any predetermined category of analysis, which therefore makes the research to have depth, openness and a deeper inquiry (Punch, 2001). A further reason for undertaking qualitative research is further supported by Barak (2005) who says that it provides researchers an opportunity in which to understand a phenomenon from a particular perspective in its entirety. For example, it was easy to gain more understanding of how the decentralisation policy was being administered in Zambia and provide a more descriptive view of the levels of co-ordination between the central and local government, owing to the fact that there has been nothing written about my subject before.

Although qualitative research is said to lack clear-cut matter and is subjective (Van Thiel 2014:150), the theory developed is based on the particular case that has been studied. The usage of theory varies in this study due to the fact that the research subjects all present uniqueness as a result of the subject area chosen which would therefore require them to have particular theories and models for adoption (Van Thiel, 2014).

A quantitative research, on the other hand, would have been restrictive in providing standardised measurements and predetermined responses. However, qualitative data is used to arrive at the quantitative data.

The qualitative research was done using interviews and questionnaires. The interview process was useful in developing a proposition and analyse the data inductively, (Lewis and Saunders, 2012). All the data from the research was obtained through the qualitative method and it was analysed manually. Both open ended and closed ended questions were applied for the interviews.

3.2 Evaluation based research

The research was centred on policy, made first when it comes to curbing environmental problems and second, the administrative side of public administration where policy had been created to enable the public sector perform in a particular way. It had been pointed out that evaluative research in policy is part of the new public management reforms. This is because nowadays, the impact of a policy is often an important source for the development of new policy (Van Thiel, 2014:8).

Evaluative research actually comes in three forms and in this case, all three apply due to the nature of the research subject.

In the first instance, research can look at a formative evaluation and study how processes happen or develop. Researchers can also perform a summative evaluation in which they study how effective a policy was. The last form is when a researcher is able to determine if a particular policy was the right one to follow.

3.3 Data interpretation

The data analysis consisted of dividing the units into even smaller units to compare the different codes with each other. For Miles & Huberman, (1994), Robson, (2002), Flick, (2002) and Silverman, (2011), this kind coding is normally one of trial and error and thereby places a lot of demands on the researcher. A code is a shorthand way of indicating the meaning of the data obtained. This was done using data reduction, where only relevant data was kept. In a deductive study, the researcher follows the guidelines of the hypotheses created earlier while in an inductive study, selecting the right data is much trickier (Van Thiel, 2014).

3.4 Field Notes

It was necessary to go through this process so that when the detailed analysis of transcribed material is carried out, it was complemented by the process that had already been started based on field notes (Strauss and Corbin, 1998). The field notes helped for one to be more challenging and to actually see which direction a study was taking.

3.5 Dynamic Performance Management approach

A Dynamic Performance Management approach is used in this research to deal with the design of policy that will bring about sustainable outcomes to the problem of environmental pollution. Its aim is to assist decision makers to frame the structure and behaviour of the systems where the decentralisation policy is being implemented. This approach also helps to detect the risks that may befall in the implementation of the policy. In this particular instance, an agency such as a local council/municipality had to identify ways by which the performance to the stakeholders would be communicated, by referring not only to the outputs, which in this case included things like publishing materials on pollution, but also to the outcomes that the public service will be able to generate, such as an alignment of public policy and policy design (Bianchi and Tomaselli, 2013).

In this research, DPM was adopted as a way to enrich performance management through the identification of policies and process changes. Such an approach focuses on the inconsistencies, conflicts and ambiguities in the decision-making process as well as the consequences on the governance, management and performance of the observed territory.

In a DPM approach, the two tiers (institutional and inter-institutional) are modelled to show how they can simplify and foster synergies between the relevant administrations to this study, such as an environmental agency and a local municipality. This is necessary to the implementation of a dynamic performance management approach so that performance and sustainability are enhanced. While an institutional perspective focuses on the institution itself, in this case the central government, an inter-institutional perspective frames the territory as though the relevant system were to comprise and manage the cause and effect relationship between performance factors (Bianchi and Rivenbark, 2012). It is necessary that a DPM approach is used to measure the outputs and outcomes of using decentralisation because the approach itself enables one to look for other ways for process improvement.

Figure 3 gives an illustrative explanation of how dynamic and complex systems such as solving environmental problems affect policy makers differently. Policy design has to be aligned to the players and in this case this includes all stakeholders who are involved in the making of the policy within the public administration system, as well as stakeholders outside the institution. It shows that service delivery outcomes are indirectly affected by policy integration outcomes.

For example, the time for which decentralisation is to be implemented in the different levels of a ministry or public organisation can be increased by designing and integrating a set of policies aimed to change a blend of strategic resources such as making information more transparent for all those involved in policy making (Warren, 2010). The end results at the lower end, associated with the outcomes of policy to be implemented, such as the contribution of mining to the gross domestic product and later to the environmental pollution rate, could be affected by the outcomes of integrating decentralisation in the environmental protection institution. This could further imply the development of other strategic resources such as communication (to enhance co-ordination) between public sector policy makers and other stakeholders in the system (Bianchi and Peters, 2016), who could include civil society organizations and donor agencies, to generate public-private partnerships.

The aggregate performance of an environmental protection institution is affected by the accumulation and depletion process of strategic resources such as skills and equipment. For example, in reducing environmental pollution, a mining company will contribute to depleting the quality of the environment in the local area as well as other strategic resources

Figure 3   A generic model of a Dynamic Performance Management approach for fostering the decentralisation policy in reducing environmental pollution
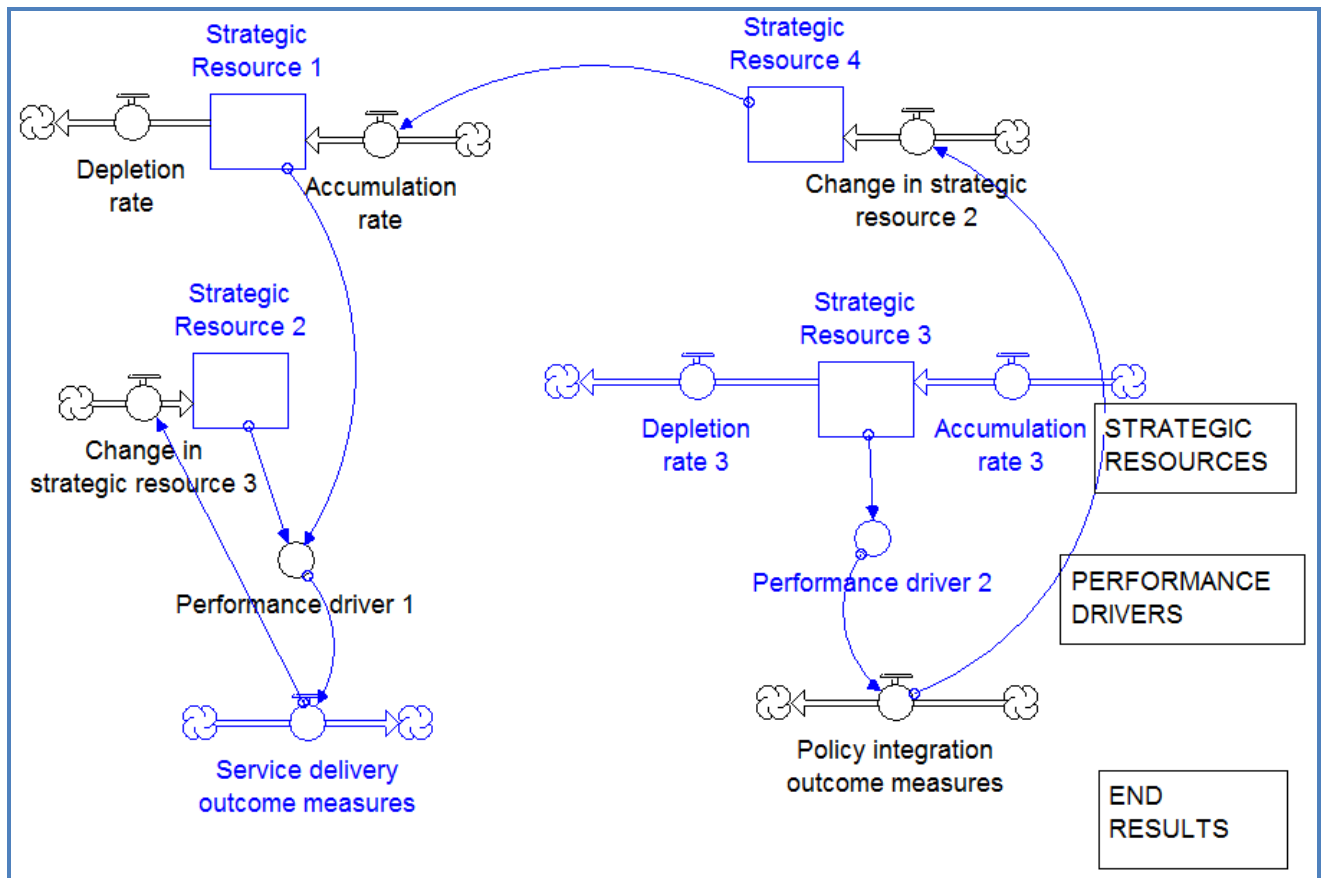
One would conclude that the approach is useful in understanding the variables used, and in identifying what the strategic resources or driving forces are. Strategic resources are the inputs that are needed in order for a system to operate effectively. In this research, the strategic resources for the mine pollution problem could be the inputs that would make the environmental agency carry out its work effectively such as skilled manpower or appropriate equipment.

In addition, the approach is useful in answering to how the range of stakeholders involved in decision making influence strategic resource dynamics, bearing in mind that the public sector is a dynamic and complex system which is involved with many players, whose roles and competencies cover inter-related domains (Bianchi and Tomaselli, 2013). Such implication is relevant in this research since performance management concerns the outcomes generated by public policies and the sustainability of performance indicators.

3.6 System Dynamics

From the onset, System Dynamics is a methodology that has never been used before in Zambia, particularly in developing government policy. However, this is a grounded theory of nonlinear dynamics and feedback control developed in mathematics, physics and engineering. It deals with how things change over time. It was first developed in the late 1950s by Forrester as a management discipline to understand how policies of corporations produce success and failures. It is applied to the behaviour of human as well as physical and technical systems. Dynamic problems according to Wheat, (2010), Sterman, (2010), and Forrester, (1985), are characterised by variables that undergo significant change in time. Hence, the defining property of a dynamic problem is not merely the variables being dynamic. More critically, in a system dynamics problem, the dynamics of the variables must be closely associated with the operation of the internal structure of some identifiable system. The structure of a system operates over time so as to produce the dynamic behaviour patterns of the system variables over time. That is to say that our actions can appear at a distant point in time and space and even with unintended consequences (Armah, 2010).

SD is numerical data. A model is useful because it allows one to see which loops are more dominant than others and in the end will show if certain policies are at all useful. In this study, government introduced certain policies through the enactment of the Environmental Management Act of 2011, and these were tested to see how the system behaves. In systems thinking, one sees the world as a complex place (Sterman, 2000). And for Forrester (2009), Barlas (1996) and King and Kraemer (1992), the structure of a system in SD operates over time so as to produce the dynamic behaviour patterns of the system's variables over time. For a real system, the structure is not exactly known.

The diagram in figure 4 shows the qualitative analysis regarding the causal relations of the variables found in this dynamic problem. The (+) sign indicates only that changes are reinforced –it does not mean that the effects are necessarily good. For instance, the left side of the diagram shows that mining policies have a direct influence on the population, which has a positive influence on the GDP growth for a country. The increased GDP has a positive influence on the employment opportunities being created thereby causing reinforcement (Reinforcing Loop) into the system, meaning that the system is growing exponentially. The (-) sign indicates only that changes are resisted-it does mean that the effects are necessarily

bad. However, no system can keep on growing forever, hence the balancing feedback system (Balancing Loop) on the right of the diagram. The number of mines will have a positive influence on the level of emissions, which will have another positive influence to the amount of air pollution. This will impact negatively on the population, thereby bringing the system into a balance. The closed loop means the situation being analysed is a feedback system. Feedback systems have a closed loop structure which brings results from past actions of the system back to control future actions. They are also influenced by their own parts behaviour (Sterman, 2000). A CLD is useful in explaining the causal relations that exist among the variables. It also shows the dynamics involved when it comes to resolving what are sometimes referred to as 'wicked problems' (Bovaird and Loffler, 2003).

Figure 4   Causal loop diagram to illustrate the causal relationship of the mine pollution problem
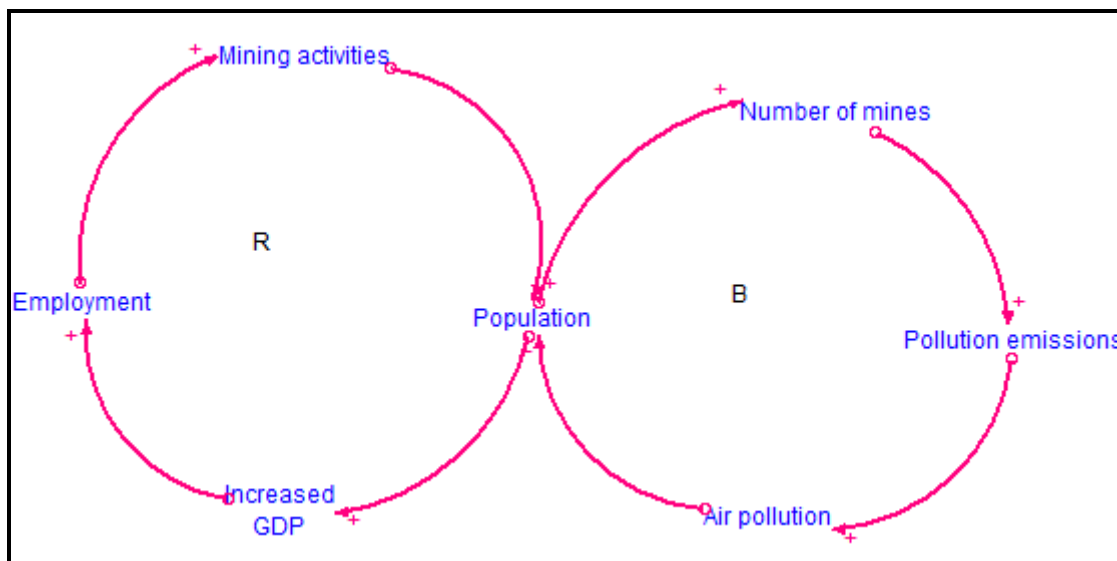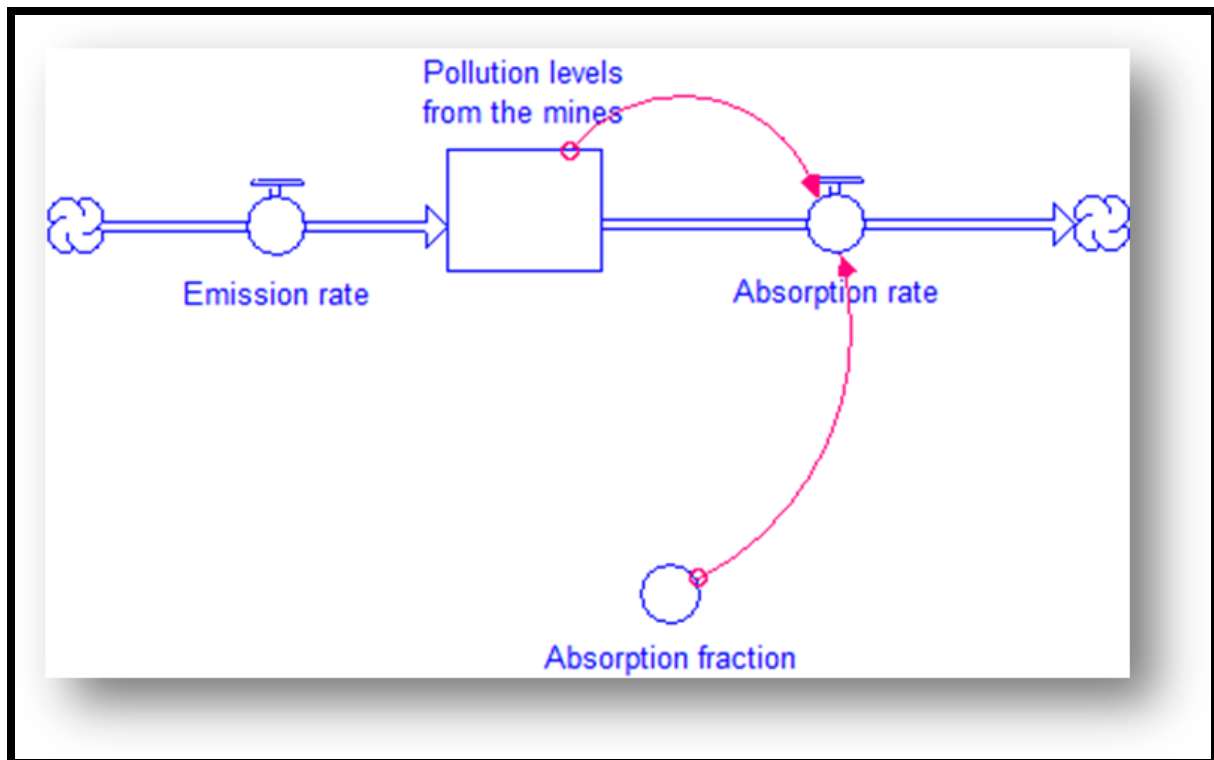
Figure 3 Stock and Flow of mine pollution

The stock and flow diagram in figure 5 shows the non-intuitive behaviour made to show the relationships between a resource, the flow rates and the factors that depend on that resource. This structure has to be linked to performance outcomes (Warren, 2010). Hence, in the diagram, the total yearly emissions can only be understood if the rising emissions per month to the average emissions per year are displayed alongside changing absorptions of the pollution into the atmosphere. The pollution from mining is the stock. It is then absorbed into the atmosphere, which causes a number of effects to life and vegetation. The stock and flow diagram has an inventory of air pollution which increases through mine emissions and reduces by absorption. Mining pollution increases through the mine emissions rate and reduces through absorption.

System Dynamics in this instance, allows the selection of other types of information using the qualitative method. It helps identify and answer the underlying questions related to pollution from the mines and how, if at all, decentralisation has been used to bring this problem to the fore. It also helps in understanding the driving forces of the performance of the municipality or local levels of government under study. It can identify the products under the public

administration in Zambia, map the underlying processes and match them to the key responsibility areas. Using this methodology is useful in developing a model or a causal loop diagram, that can be used in decision making and measure the key performance indicators and the factors impacting on them (Bianchi and Cosenz, 2014).

Another feature of this methodology is that it helps to capture the intangible parts of the system such as policies and human resources. It is, however, not, used as a standalone methodology, hence the reason the DPM approach is favoured in this research. This is because it cannot answer the questions as to what views, dimensions and time frames are of most importance and should be included. Its use does not take multiple conflicting views and dimensions over time into account and neither does it allow the integration of qualitative data in the selection of information to be used.

Chapter Summary

This chapter explained the methodologies for the research. A SD approach is used in this public policy problem to show the cause and effect relationships, feedback loops, delays, physical information links as well as the decision rules that would affect the behaviour of the system in the implementation of decentralisation. In the DPM approach, the focus begins by first understanding the strategic resources, performance drivers and the end results. The dimensions of vertical and horizontal co-ordination between the different stakeholders are necessary in understanding how the policy will work. This is the reason that the latter approach is mostly favoured in this research.

CHAPTER FOUR   FINDINGS

4.0 Introduction

Mining in Zambia has not been consistent with the effects on the environment. Much of the focus has been on achieving economic growth. Policy development around the pollution problem has been created, especially during the last ten years. However, there has not been a multi-stakeholder approach. The public sector lacks adequate management due to the absence of proper co-ordination and enforcement mechanisms of the legislation currently in place.

This chapter discusses the findings from the various interviews with stakeholders and site visits. In order to do this, a Dynamic Performance Management perspective was used to show how different players can co-ordinate their activities and show how they can work through decentralisation. This was followed by the use of System Dynamics to explain the causal relationships through a Causal Loop diagram to explain the variables and cause and effect relationships used in this discussion.

4.1 Kabwe Case study findings

The pollution in Kabwe was first noticed after a study was done in 1975 by A.R.L Clark from the London School of Hygiene and Tropical medicine. His study indicated that the primary pollution pathways, causing lead contamination from the mine included atmospheric soil, vegetation and water pollution and these were from the predominantly affected towns of Kasanda, Chowa, Makululu and the Mine Municipality areas. It was found that the dense fumes from the smelter were rich in metallic pollutants such as cadmium, copper, lead and zinc (Clark, 1975). Since these metals are non-biodegradable, their pollution is long lasting and would entail pollution remediation strategies in the future. It was this study which only much later compelled for the cleaning up of the town through the Copperbelt Environmental Programme (CEP). Knowledge of the lead pollution in Kabwe and its harmful effects on the local people was well known, but not publicly disclosed by the government.

Lead content in the air is measured in milligrams per kilo gram. The thresshold for lead contamination is 400mg/kg but one finds that areas such as Kasanda, Makandayama and

Chowa have lead contamination of 3, 000mg/kg, 1, 600mg/kg and 1, 200mg/kg respectively. In most areas of Kabwe, soil is the sole primary lead (Pb) source. About 40km of land in Kabwe exceeds the 400mg/kg threshold for lead contamination.

The pollution levels in Kabwe were also detected through the level of lead in the blood content of the population.. The blood level content is therefore checked for lead due to the inhalation of the dust. The poor vegetation cover in much of Kabwe has resulted in a very dusty environment. Areas with close proximity to the mine such as Kasanda, Makandanyama and Chowa indicated high levels of Pb, because of the fugitive dust that emanates from the waste dumps (ZCCM, 2006). Kasanda had the highest concentrations.

The Environmental Impact Assessment regulations for Zambia are compatible with international requirements and are based on international standards. In 1996, an Environmental Impact Study was done to act as the initial baseline for meeting the safety, health and environmental requirements for future mining investments. Given the serious nature of the environmental pollution and its impact on the health of the residents, some investors, specifically the mining consortium (KCM), refused to accept any legal responsibility for the pollution, owing to the way the Mines and Minerals Act was drafted. The responsibility now remained with the government and its subsidiary ZCCM-IH to take the responsibility for potential future claim arising from past environmental damage.

Today, Kasanda township is the most affected by the pollution from lead. This has to do with its geographic position, where its relative proximity to the mine leads to the prevailing winds from the mines to first pass through it. The township is only about a mile further from the smelter stack. What is even more interesting is that this township was built on what used to be the mine's waste rock. Another affected township is called Chowa. Due to its location east of the mining site, winds blow upwind through the township, making it more susceptible to the lead pollution, before blowing towards the mine site.

In 1997, after decades of widespread contamination, the effects of the pollution from the lead and zinc mine influenced the perception amongst the policy makers to set up a project called the Copperbelt Environmental Project (CEP) through the World Bank. It allocated about US$40million through this project. The remedial measures to clean up the environment

included setting up an information centre, which was to create public awareness on the effects of pollution. The education was also meant to influence behavioural change amongst the general public. Secondly, certain plants were planted to remediate the effects of pollution through a process called phyto-stabilisation, (Bolan 2011), a technique meant to contain the topsoil pollutants within the subsurface by accumulating the pollutants in the plant's roots or through precipitation within the rhizosphere, a region in the soil that is controlled by the root system of a plant process. The process actually prevents offsite contamination through pollution pathways such as wind, water or soil dispersion. Thirdly, the soil in the affected areas, such as Chowa and Kasanda, was replaced, by removing the contaminated top soil.

However, the idea of cleaning up Kabwe is a complex one, as some of the areas require drastic remedial measures while in some cases, entire populations will have to be relocated. The CEP project was a failure as it was found to be unsustainable because the central government did not involve the local councils in its work through decentralisation. Pollution is still present in Kabwe, as observed from the high lead blood levels. The other policies and laws did not address the issue of the lead from the mine dump sites. Local people are still scavenging the dump sites and are using the lead to make floor polish, for example, therefore bringing the lead directly in their homes. Out of a sample of 15 people spoken to, only one person was aware of the implications of lead poisoning as a result of mining while the rest could not connect this to the health problems being experienced by some residents. In the meantime, the government of Zambia has requested for another World Bank loan totalling $60 million to be used to help clean up polluted areas from mining in the entire country. The money will be used in four cities namely; Kabwe, Mufulira, Chingola and Kitwe.

Some policy measures were put in place to tackle the pollution problem in general and these were:

4.1.0 A Super Fund for cleaning up the environment

A fund meant for post mining rehabilitation called the Environmental Fund was established under the Ministry of Mines. It was meant to clean up the surrounding mines areas after mining has been exhausted, through contributions which are made by the mining companies themselves. The contributions are determined by the amount of mining done by the

companies. But even though this is the case, there is, however, a dilemma for the case of Kabwe as this fund is not meant for sorting out the pollution there. This is because when this law came into place in 2011, the lead and zinc mine in Kabwe had already been closed.

4.1.1 Fines

The EMA provides for penalties to those causing pollution, through the payment of fines and even imprisonment. However, since the agency does not have adequate staff and portable equipment to monitor the levels of emissions, there are a lot of gaps in baseline data collection, making it difficult to state the exact extent of the pollution levels from the mining in Zambia. Equally, it was found that it became a challenge for environmental entities to give a comparison of what the levels of pollution where before one form of intervention and the situation after the intervention.

What is known for sure is that most of the pollution done is from the old mines which are present on the Copper belt province. These mines have old equipment which did not take the effects of the emission effluents into consideration. The new mines, which are found in the North Western province on the other hand cause less pollution because their machines are modern and are made in such a way that they are able to revert most of the pollution caused from effluents.

4.1.2 Public awareness

Zambia lacks proper environmental awareness. A study of the local newspapers showed that on average, there were only two articles published on a monthly basis that looked at environmental issues. In Kabwe, where cases of pollution were first reported, there is only one billboard that has been put up, which talks about the effects of environmental pollution from the mines. One of the conclusions drawn especially by the civil society organisations was that environmental issues were seen as being elitist. Efforts have been made in the past to produce literature on the environment but this too has not been appreciated by the public. Most of the environmental lobbyists complain of the lack of resources to carry out sensitisation campaigns. The political will is also not there to seriously bring out environmental problems to the fore.

4.1.3 Capacity building

This is one of the major problems hindering progress in curbing environmental pollution from mining activities. The environmental protection institution lacks the capacity in terms of requisite technical personnel and finance, which is often limited given the broad scope and coverage of matters to do with the environment (Salami, 2001). Financial resources are required first to train the personnel and secondly to buy the necessary equipment that can be used to capture the pollution levels. Section 43.1b of the ZEMA act gives power to the minister to appoint qualified persons to act as honorary inspectors to monitor discharges and pollutants from the mines. But even with this in place, it is difficult to find qualified people and the appropriate equipment for this.

What was also observed from the findings was that the local municipality was not involved in any of these measures. In addition, there was clearly a lack of co-ordination, first at an inter-institutional level and then at a multi-level. The local municipality, though partially decentralised, does not have the necessary technical expertise nor equipment to adequately deal with cases of pollution. In fact, pollution is not seen as a major problem.

4.2 A System Dynamics approach of how decentralisation can help reduce environmental pollution from mining

Under this approach, it is necessary to show the causal relationships of the different variables. This was done by showing a Causal Loop Diagram (CLD) in Fig.6. If a mining policy increases the standard of living in an area, more people will migrate to that area, consuming resources such as food and businesses. This will cause more mining and a decline in the quality of the environment. The figure is therefore depicting a reinforcing loop, because the whole system is generating growth. The demand for minerals plays a significant role for the amount of mining carried out.

Hence, when demand increases, more mining is carried out. This also has a positive effect on the population since it creates a lot of employment opportunities. Zambia has a high unemployment and poverty rate, which is mostly experienced in the rural areas. As a result of this, feedback loop R1 shows how an increase in mining will have a positive effect on the

employment opportunities and subsequently the lifestyle of the people. They will now be able to afford not just the basic necessities but certain luxuries as well.

Figure 4 CLD mine pollution
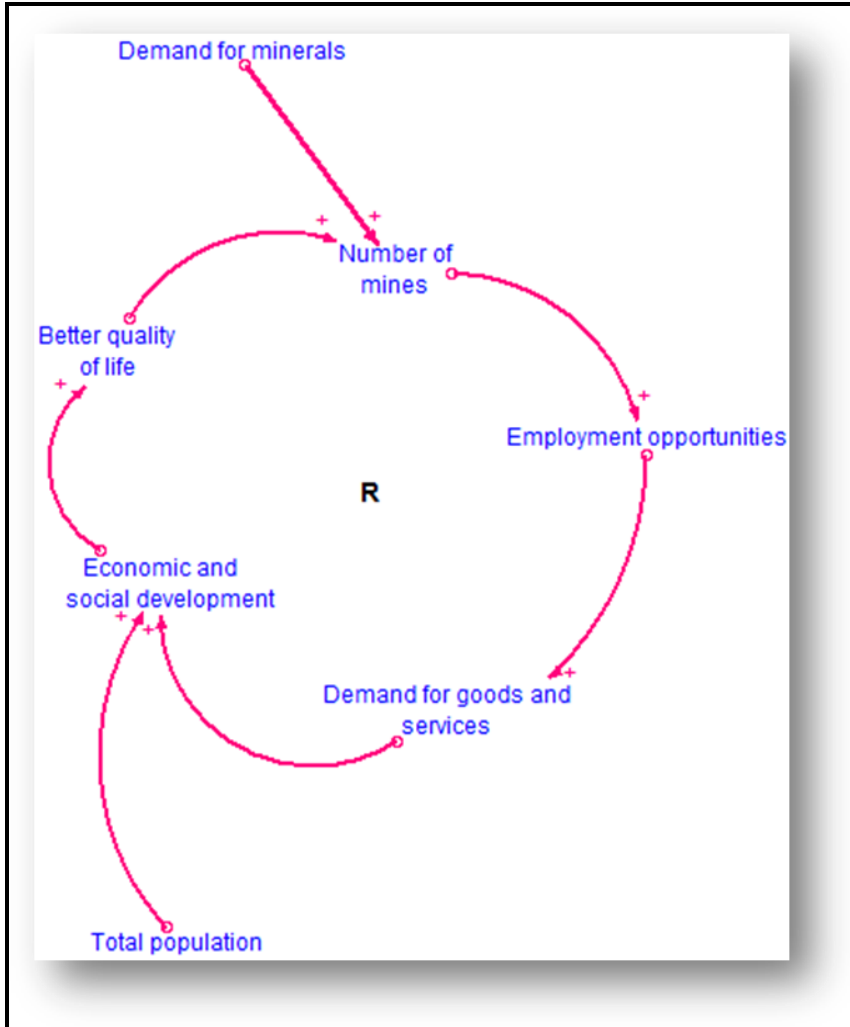
While mining generates positive changes to the economy, this is not sustainable. For anywhere where there is mining, there is always some sort of pollution.

In Fig.7, increased mining results in increased mine emissions which subsequently become detrimental to the environemment and its citizens. This calls for a change in policy and one of them is decentralisation. This is because for any economic instruments to be well implemented, there must be a well functioning state of institutions in place through decentralisation of the public sector. Decentralisation is supposed to make it easier to

understand the environmental concerns of the citizens at the grasssroot, as this is where most of the pollution occurs.

As levels of pollution increase, which in this case is observed through the health of the population, policy makers are influenced to take necessary measures to ensure the environment is clean and that people are healthy. There has been much environmental degradation in Zambia as a result of the Kabwe lead and zinc mine, such as dust fallout and discharge of suspended solids and waste (Banda, 2012). Because there is no growth that goes on forever, the balancing loop offers a corrective action. This depiction of the CLD helps to identify the main problems and the relationships that exist among the variables as well as the linkage of using decentralisation as a policy measure.

Figure 5 Problem CLD and policy implications
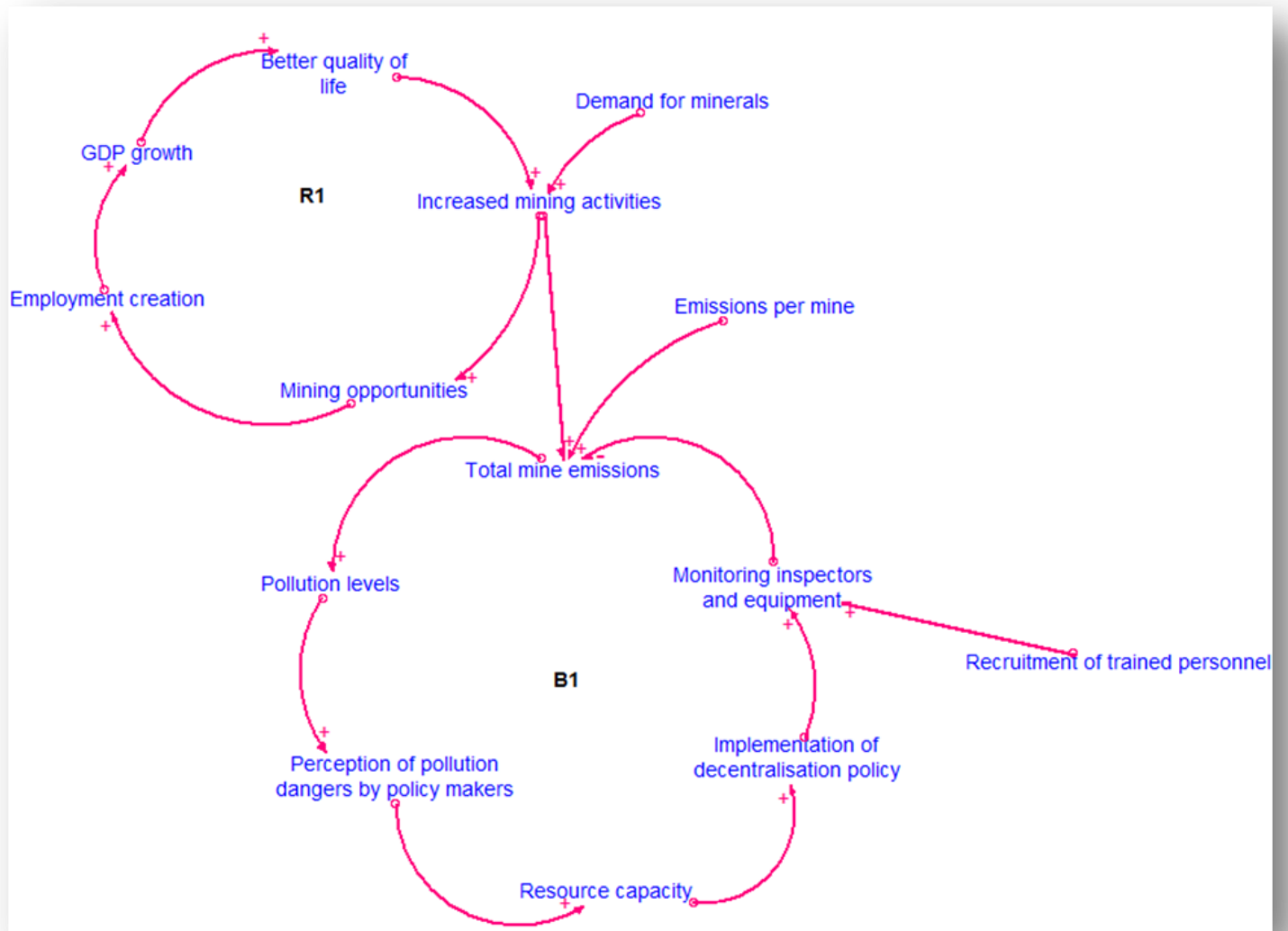
Lack of information was noted as a reason for the negative effect of the levels of pollution as it meant that the public was unable to bring any litigation against companies that were found polluting the environment. Therefore, changing perceptions is a big step to ensuring that something is actually done about a problem. It takes time for perceptions to change, thereby causing a delay. However, as shown in Fig.8, it is only when this perception is changed by the public through access to information, which corrective action can be taken to control the pollution. This is explained in Fig. 9, where mines are required to carry out environmental impact assessments. These reports indicate the level of pollution expected to be caused due to the mining to be carried out. The change in perception is what is going to compel policy makers to dedicate resources which should put pollution control measures in check.
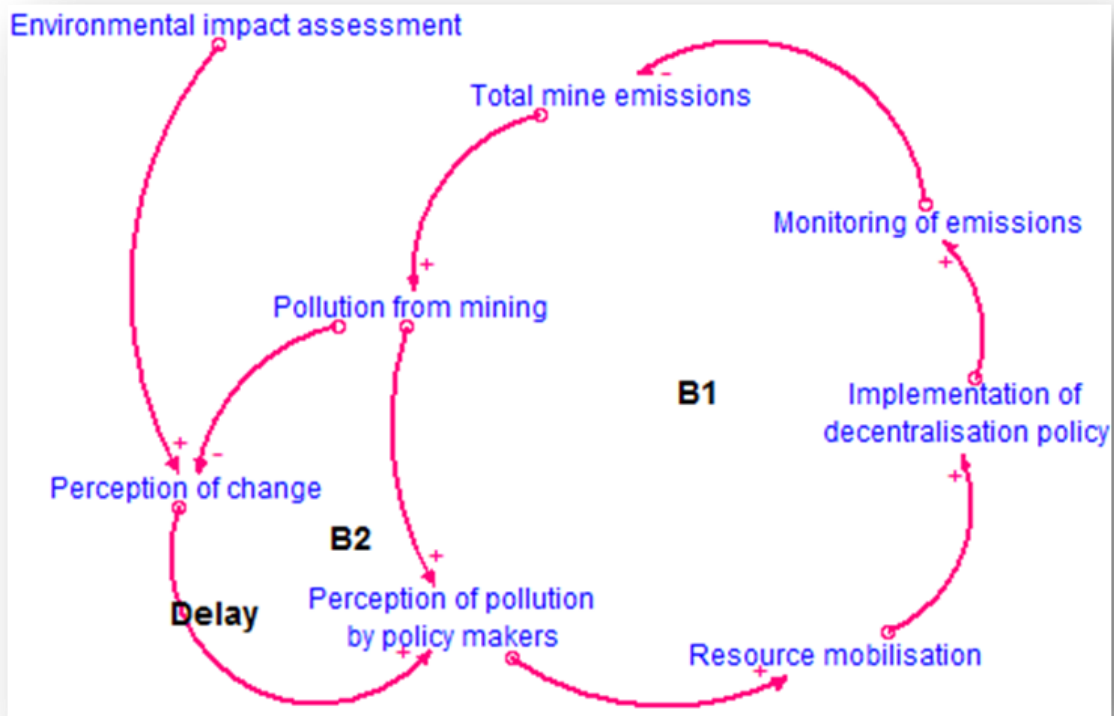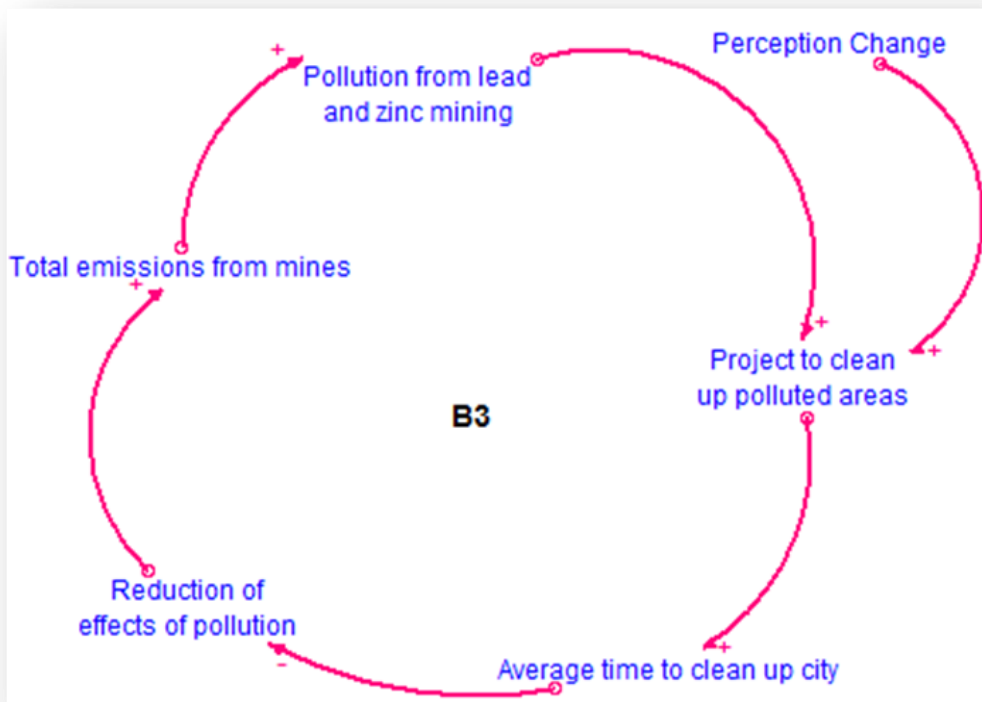
Figure 6 CLD of perception change

Figure 9

Because mining poses a lot of environmental and health hazards, the ideal situation is to have the pollution level brought down to acceptable standards. A stock and flow diagram in Fig.10 shows the desired emission rate from the mines. A goal was created with an adjustment time to give us a gap that would exist from what is currently prevailing. The desired adjustment rate closes the gap. By creating the desired emission rate, we are trying to bring down the pollution levels by undertaking mining while conserving and protecting the natural environment, as contained in the Mines and Minerals Development Act of 2008.

Dividing the desired emission rate with the number of mines enables us to come up with the same average of emssions that can be allowed per mine.

Figure 10 Stock and Flow of hypothetical desired emissions
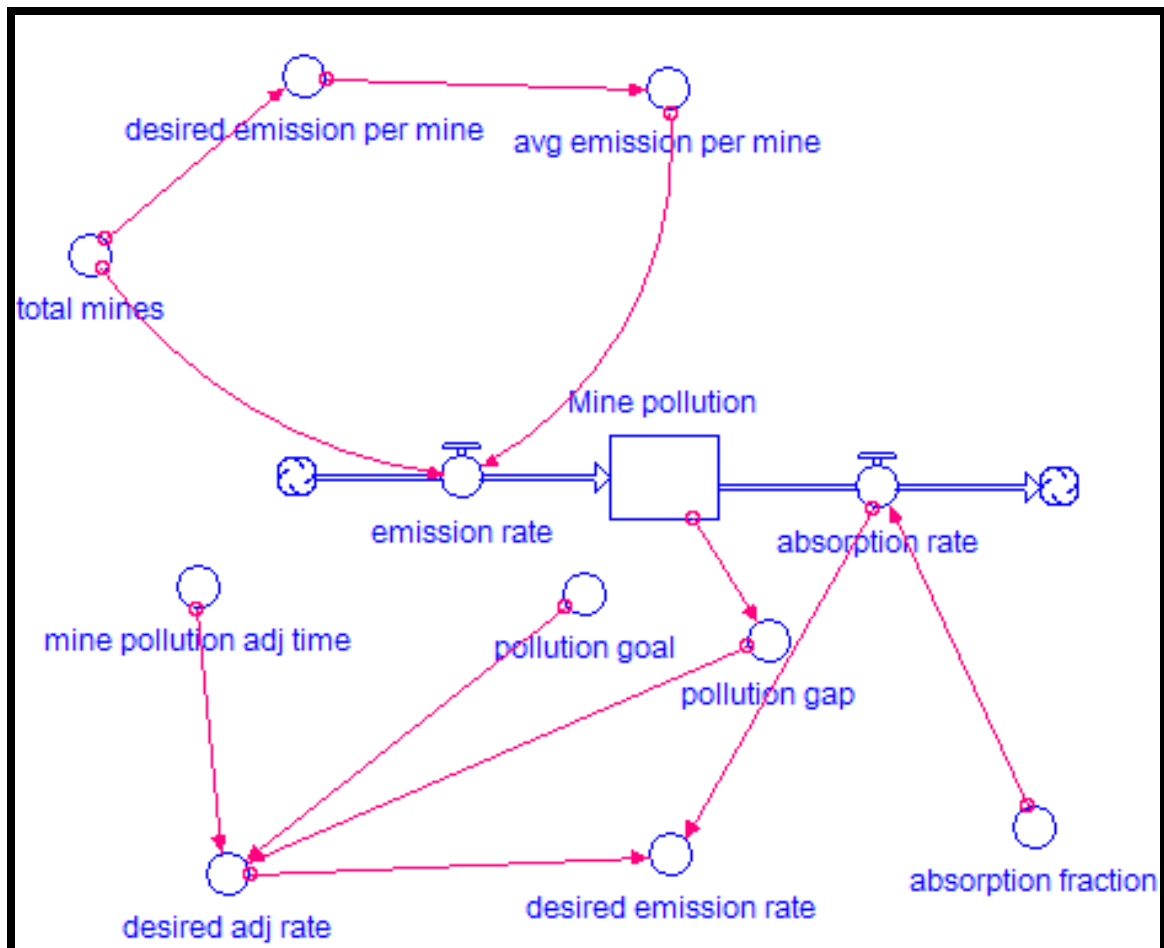
The model in Fig. 11 shows how implementing decentralisation can be one of the ideal policy measures.

Decentralisation is an important part of stakeholder-based environmental decision making to enable the establishment of processes for addressing the complexities of environmental problems (Duc et al, 2014). It is through decentralisation that environmental issues as well as enforcement of regulations can potentially lead to a more efficient and transparent system of pollution control and management. It is also through decentralisation that institutions and public organisations are able to mobilise for resources for the procurement of monitoring equipment.

In the model below, the perception of harm is used because this is what determines how quick policy makers are able to make make policy. The higher the perception of harm, the quicker policy makers are able to do something about the problem.

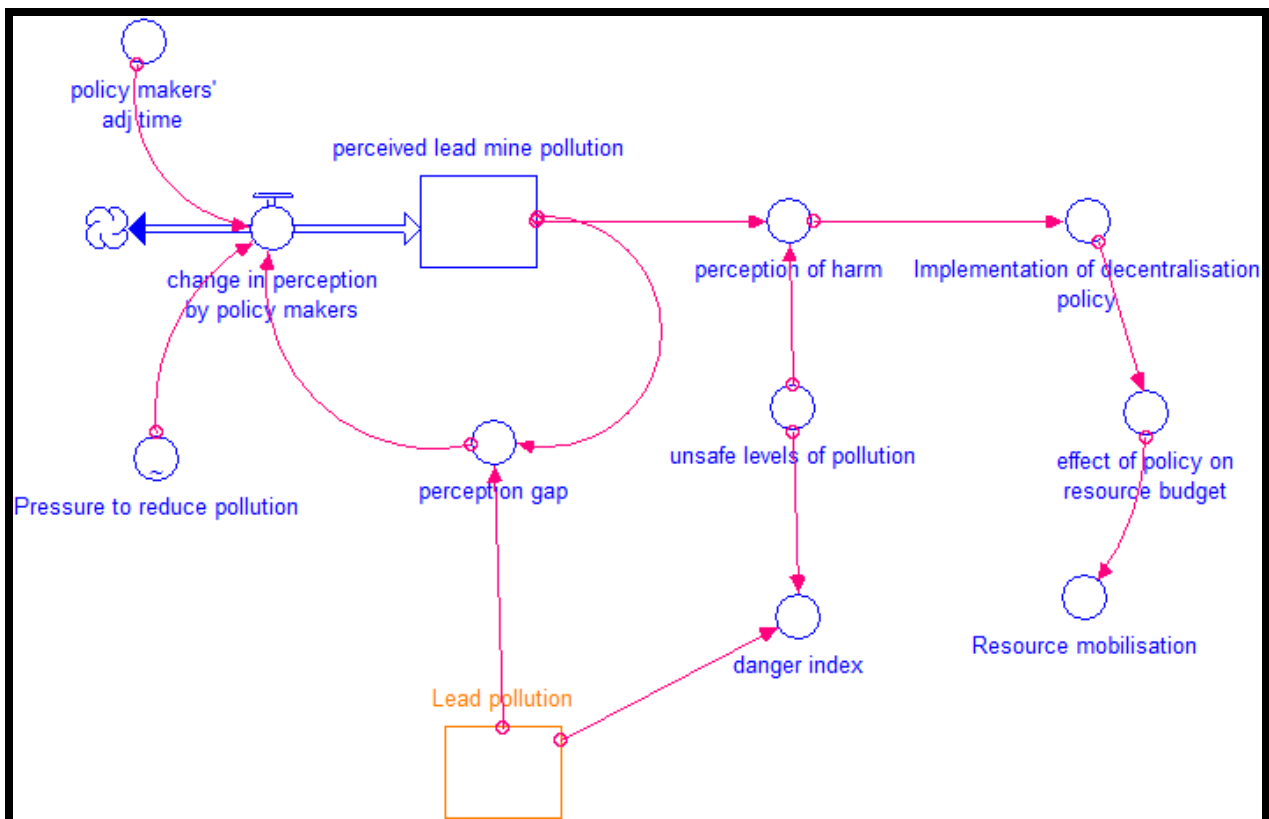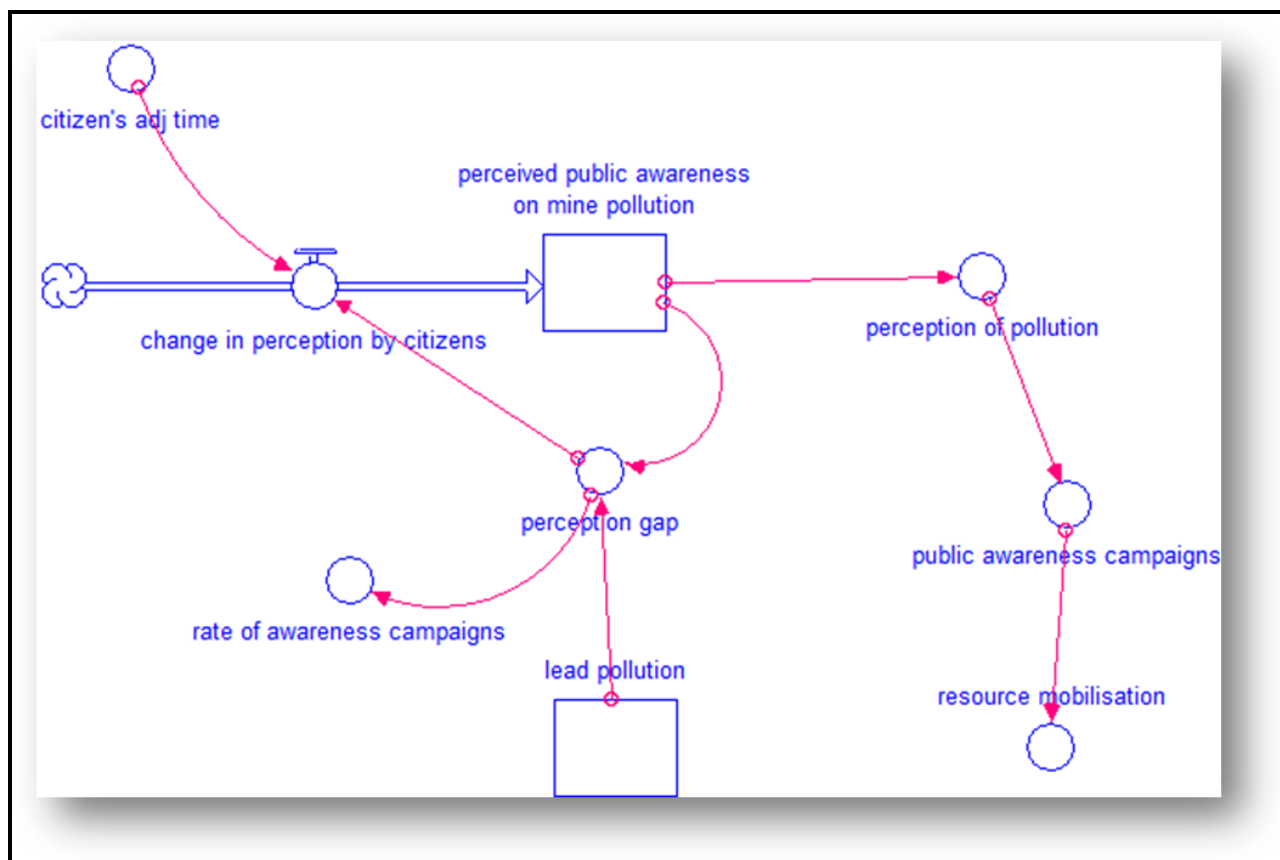**Figure 11 Stock and Flow for implementation of decentralisation policy**

Figure 12 Stock and Flow of perception change

Part of the main findings from the interviews indicated that the pollution levels have not been brought down to the anticipated levels due to lack of information for the citizens. In the Kabwe case study, it was found that most people attribute the sicknesses being experienced to witchcraft. The loop in Fig. 12 shows how the perception gap can have an effect on the rate of awareness campaigns. When people are aware, there is then more likelihood to push policy makers to come up with appropriate policy.

Monitoring equipment is determined by the goal for the budgeted equipment. The type of equipment to be used in carrying out monitoring of pollution is expensive for a developing country like Zambia. As shown in Fig.13, the average cost for the monitoring stations is US$500, 000. Given this average, we can come up with the budget for the desired budget and then produce the desired number of monitoring equipment.

Figure 13 Stock and Flow for desired monitoring equipment
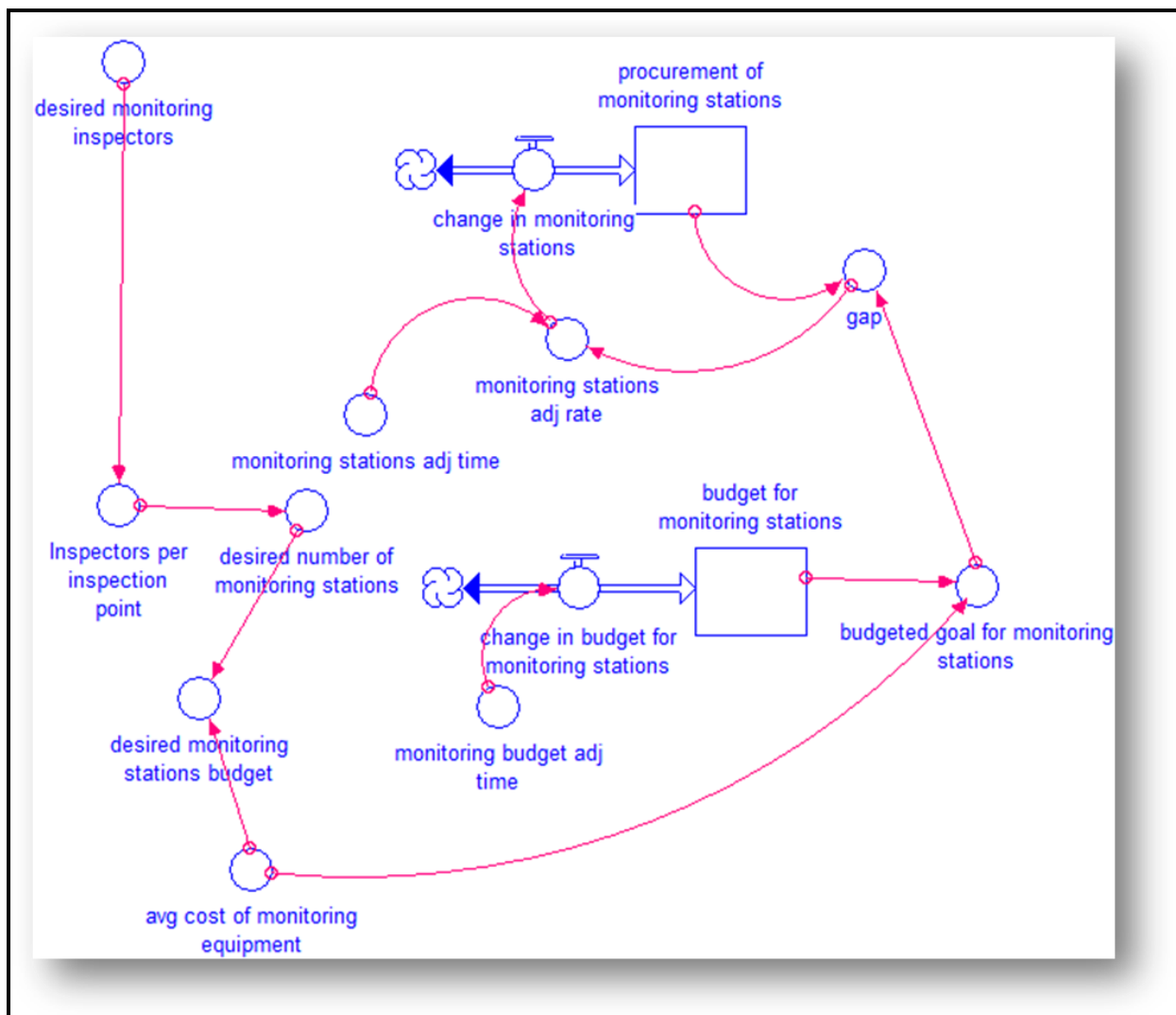
While ZEMA has been in place since 2011, the agency is still struggling with its operations. Besides the absence of equipment, there is a shortagage of skilled manpower. According to the EMA, the Minister in charge of the Emvironment is obligated to apoint Honorary Inspectors, but these too have to have specialised skills. As shown in Fig.14, recruitment can either be done at one time or in phases, depending on the amount of resources budgeted for. The findings from the research, also showed that the absence of skilled manpower has compelled mining companies to come up with EIA reports which are biased towards the mining companies.

Figure 14 Stock and Flow for desired number of inspectors
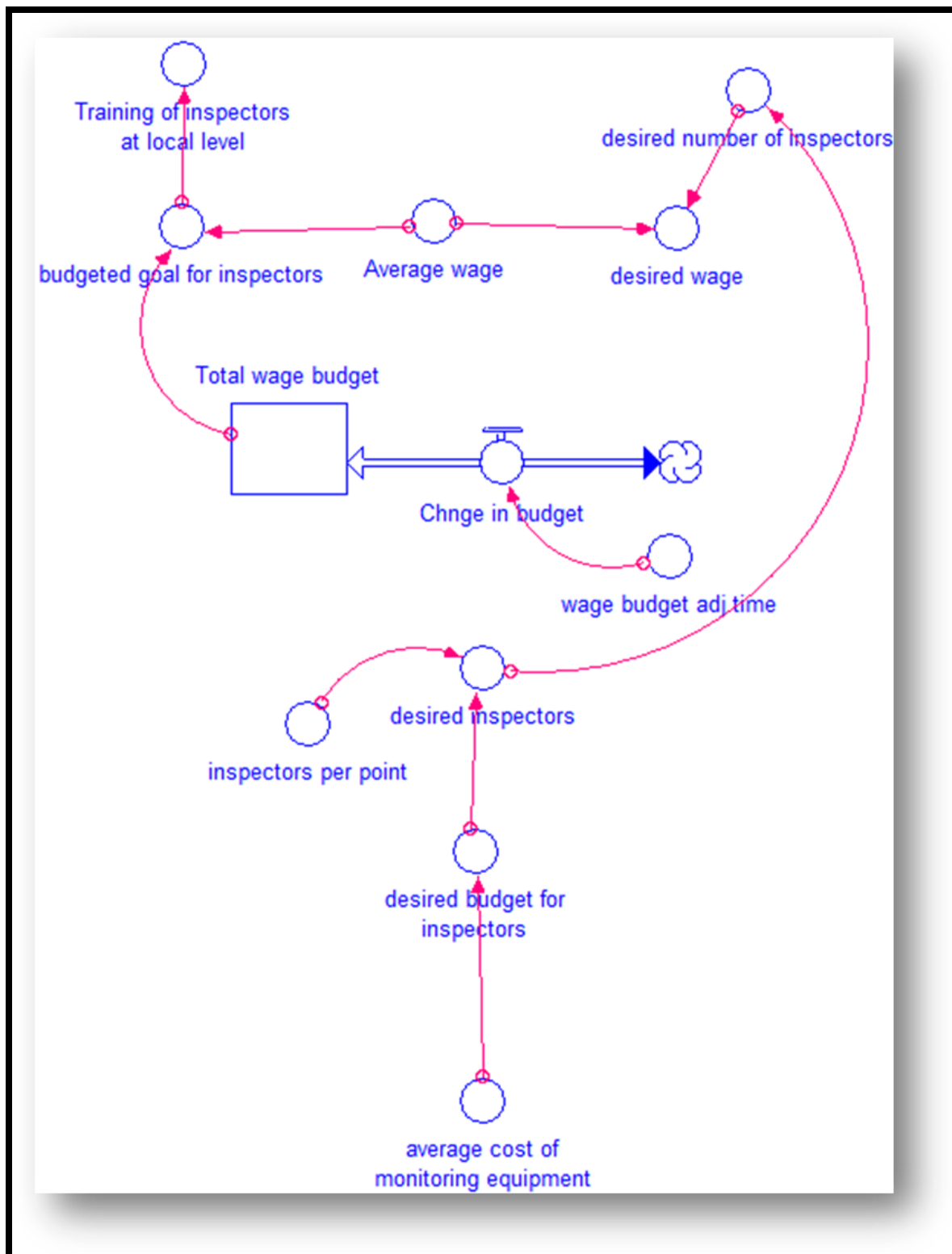
4.3 A Dynamic Performance Management (DPM) Approach to curbing pollution from mining

A DPM approach looks at the analytical framework in using decentralisation as a policy measure to curb environmental pollution from mining. The relation between decentralisation as a strategy and the effects of its performance were discovered, though these were not explicit due to the lack of co-ordination among policy makers. This approach was useful in evaluating the decentralisation strategy in the political, administrative and horizontal levels. The hypothesis is that the performance of decentralisation in public organisations has not been effective in bringing down the pollution levels from mining.

As shown in figure 15, decentralisation, in this study, is a strategic resource, which is strongly influenced by political will. The end result of this is a change to decentralisation, to enable the various players better co-ordinate their activities. The local level, where this pollution occurs, is well placed to know the activities that have to be undertaken so that pollution is managed. Under a DPM approach, the strategic resources, performance drivers and end results are made explicit so that alternative means of improving performance can be found.

The findings from the case study showed that the democratic control and accountability as well as the horizontal co-ordination are assumed to improve only in limited ways. The conjecture here was that there were fewer stakeholders involved in decision making due to lack of information sharing. The vertical level had more stakeholders even though, here, too, information sharing was a challenge. There were different interests and commitment for the environment, for example, between government officials and NGOs.

Mining, decentralisation, legislation, equipment and qualified manpower are all examples of strategic resources in the case study. The strategic resources were realised by understanding which ones were able to bring about satisfactory results to the reduction of the pollution in Kabwe. For instance, both having qualified staff and equipment provide capacity which will affect service quality for both the environmental agency and the local municipality in order to carry out effective monitoring as well as enforcement of the pieces of legislation on pollution.

Evidently, there will be delays in how the strategic resources and end results are influenced. This comes from the performance drivers.

At the local municipality level, decentralisation was seen as the ideal policy intervention although the municipality was not yet designing and executing policies on the environment independently. This is always a problem when power is still centralised. What this showed was that there was need for horizontal co-ordination between the local units. On the other hand, the dimension of vertical co-ordination displayed the need and ability to co-ordinate policy formulation and implementation between the various levels of government. From the findings, it was evident that there are serious deficits in the vertical co-ordination between the departments and the state. There was no formal hierarchy in the execution of decisions within the local municipality. Even though they have been decentralised, most of their activities remain a preserve of the central government, and as Politt and Bouckaert, (2004) have argued, smaller cities lack knowledge, financial and personnel resources to fulfil their planning functions.

It can be concluded therefore that a DPM approach helped to show that for decentralisation to work, there was need to enhance co-ordination among the various players.

Figure 7 Dynamic Performance Management approach to decentralisation
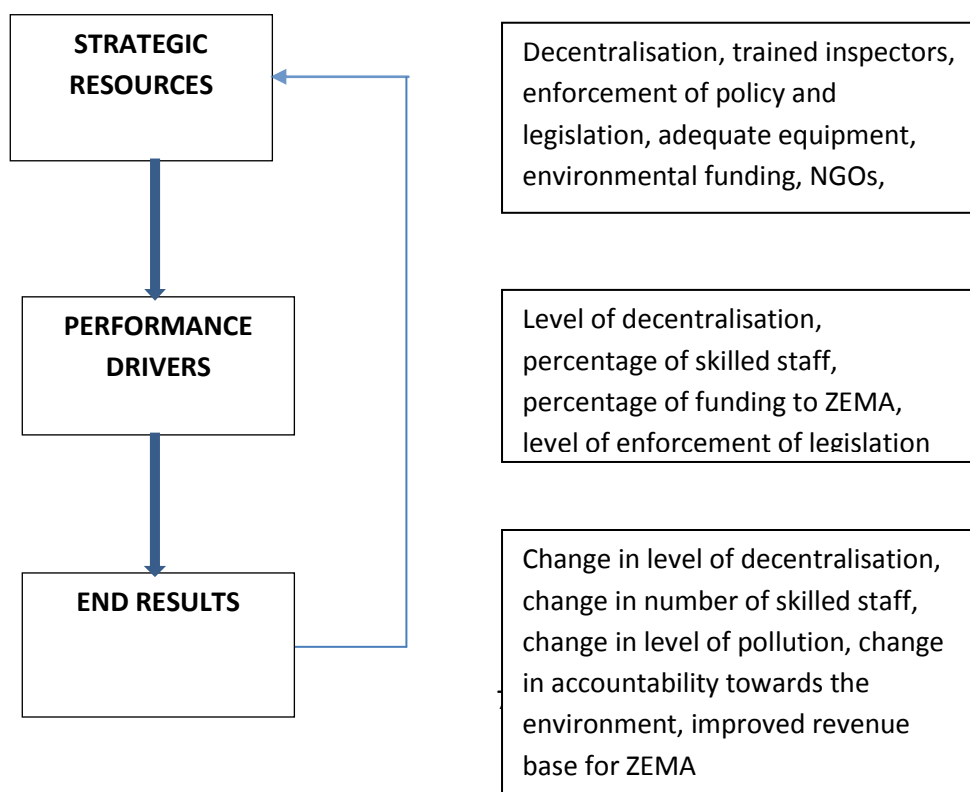
Chapter Summary

Ensuring a balance between mineral exploitation and reduction of the environmental impacts of mining poses a big challenge for Zambia without the implementation of decentralisation. In the same vein, implementation of decentralisation as a policy measure poses some difficulty, seen mostly from the political aspect and appreciation of the management concept itself. The findings in this chapter show that the environment is indeed a complex problem and to tackle it would need a multi faceted approach, using decentralisation. The SD analysis brought out the causal relations and how they affected each other. This was important before coming up with a DPM approach, using mostly the qualitative data from the interviews.

CHAPTER 5   DISCUSSION

5. 1 Model testing and validation

The main goal of validation in system dynamics is to model what is the reality so that you are confident in it and it can act as a policy measure. But it is also correct to say that there is no perfect model. A model is useful when theory can be proven (Forrester, 1978). Developing confidence in a model also makes one to make improvements to what is there. Validity and validation of a model as argued by Barlas, (1996), can not be entirely objective or formal because of science and theories of knowledge. In effect, "no particular representation is superior to others in any absolute sense, although one could prove to be more effective.no modeler can claim absolute objectivity, for every model carries in it a modeler's world view (Barlas and Carpenter, 1990).

This part of the study summarises all the tests carried out during and after the model buidling process.

5.2 Structure Test

In the simplest form, a structure test is testing the model to see whether it complies with the real world. It consists of the feedback loops, stocks and flows and non linearities that are created through the interaction of the physical and institutional structure of the system (Forrester 1990).

5.3 Parameter Test

The parameters used in this study are data that was realised mostly from interviews. Most of the data that is in secondary form is not current. In some cases, it was difficult to find the actual data because there is no documentation available. Accurate data was obtained from the Zambia Environment Management Agency, even though in some cases, they didn't have the current data due to the teething problems faced by the agency.

5.4 Behaviour Test

The behaviour of a system is a product of its structure. The main focus of the behaviour test was to analyse the behaviour of the system due to the structure. The behaviour tests were carried out using the major loops; B2, B3 and B4.

Figure 8 Response to shock
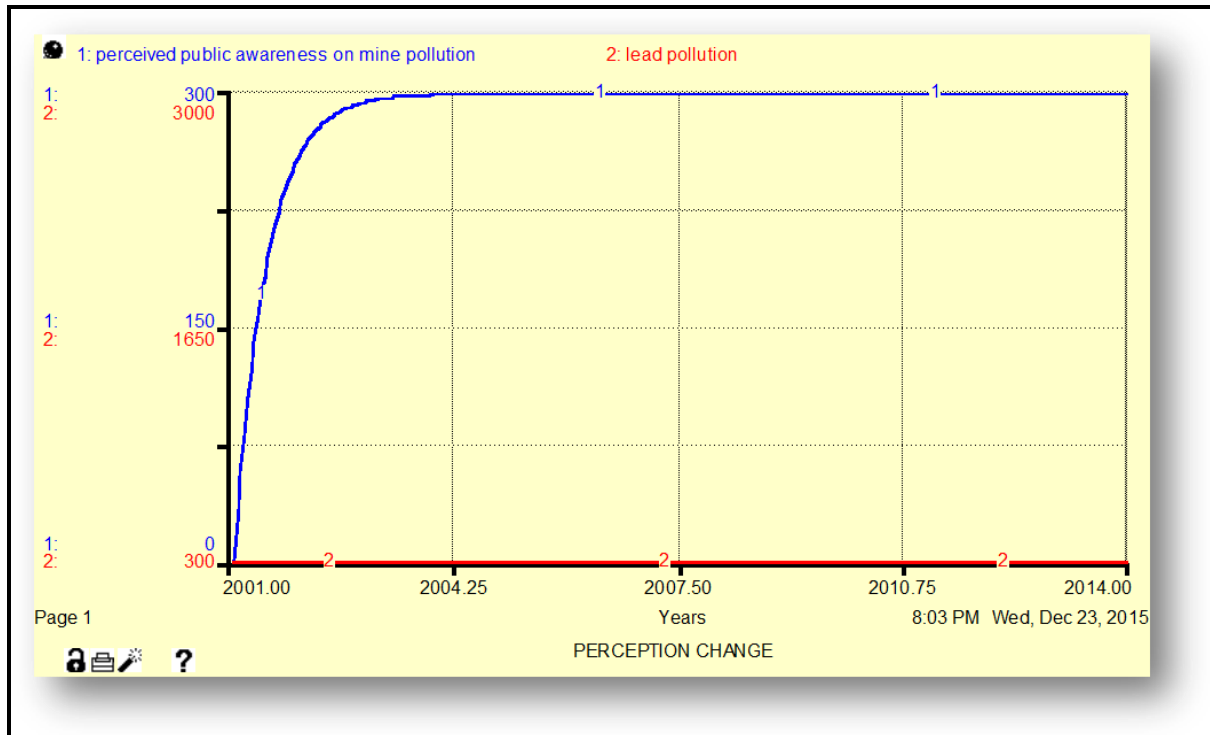
A sudden change in the DT from 0.01 to 0.5 increases the level of awareness and brings down the level of pollution to acceptable levels.

Figure 9 Adoption of decentralisation policy

The combination of the implementation of the decentralisation policy gives an indication of the extent to the level of mine pollution. If decentralisation had been implemented from 2001, the levels of pollution are showing that they will be in equilibrium. This is not the change that we want to see for Kabwe. The pollution levels are expected to be reducing at a higher level. However, the perceiveness to the levels of pollution is supposed to increase, therefore creating more awareness which will compel policy makers to implement decentralisation in the soonest time possible.

From the above validity tests, the lead pollution levels could change with the implementation of the decentralisation policy. However, this will take some time.

From a system dynamics perspective, the success or usefulness of this technique is not easy to tear apart. Models are indeed useful to make decisions in a more holistic way or indeed help to better understand a problem. Because of the complexity of environmental problems and also the desire to find solutions for them that will benefit both the economic aspect and

the moral aspect, there is need to embrace communication in a participatory way so that there is as indicated by Wang (2012:209), a "nexus of science and social concerns".

5.5 Other policies to be adopted by Zambian policy makers

With the coming up of more mines, the EMA may be weak because there is lack of enforcement in the regulations. There are also views that environmental law is not enforced but is supposed to be self-enforcing. In some cases, the regulations are not firm enough especially in cases where new mining companies are being set up. The environmental agency has also failed to give a precise classification of the type of pollution caused by the mining companies. It was also observed during the study that there were situations where the mining companies were hiring private environmental experts to prepare environmental assessments reports, a preserve of a government entity, which in almost all cases will favour the voice of the employer.

Although environmental standards for mining pollution are determined by the central government, the evidence does suggest diffferences in terms of enforcement and compliance (OECD (2006); world Bank (2006). The Mines and Minerals Act for instance, allows the Minister to publish information on the environment as he may deem fit. This means that the Minister may act on personal interest or on information that has not been scientifically proven especially when it comes to the toxicity of certain elements to the environment. Hence, one of the formal policy measures that can be adopted by policy makers is to involve civic organisations to participate fully the pollution problem. After all, Zambia has a democratic system in place which allows for the registatration of NGOs and people are empowered with the use of public interest litigations to demand for interventions of the judicial system.

This was a case in point in 2014, when a Canadian mining company applied for a prospecting licence in one of the most pristine areas of Zambia called the lower Zambezi. As per law, an Environmental Impact Assessment was carried out and it was discovered that this area had a fragile ecosystem hence the agency could not allow them to mine in that area. The mining company appealed to the Minister of Mines, who overturned the decision, saying that the company would create about 400 jobs for the local people. However, about 100 local environmental NGOs protested against this move, which led to the High Court to halt the Canadian company from opening the open pit mine (The Post Newspaper, 2014).

Where natural resource industries are owned by the government rather than the private sector, there are less chances by the environmental ministries to take action. This is because often, national or regional policy priorities lie outside the environmental realm and environmental agencies may not have sufficient political capital to bring about meaningful policies of any type. This lack of power will hinder all types of policy initiatives toothless. Hence, the true form of decentralisation does not lie in the creation of laws but more in enforcement of regulations already in place (UNEP, 2004).

At best, the direction of the effect of environmental policies on macroeconomic variables such as GDP, productivity, employment, investment and trade, is far from clear. The long term effects of an increase to more stringent measures towards environmental pollution from mining could indeed have productive consequences that create a win-win both for economic reasons and for sustainability of the environment (World Bank, 2006). While there is fear that these policies could be a burden on the economic activity of a country, it is believed that with an intensive awareness and education campaign, attitudes and values are able to change. This can be done by using change agents such as the NGOs, who can be cultivated by officials within the public service to pass on information and ideas about sustainable mining to other communitties.

While the government has put up a special fund within the Ministry of Mines, using the "polluter pays principle", the charges must be ideally set in accordance with the true cost of the environmental damage caused. In much of a similar action, there is need for policy makers to make environmental pollution a cross cutting issue in every government ministry and institution. Such a deliberate measure would ensure that there is collaborative effort when dealing with the environment. It would also bring about resource sharing, which ulitmately would have a snow bowling effect as the strength of environmental organisations and protection agencies would be enhanced. In this way, environmental issues would be tackled in a holistic manner, especially that resources in ministries would be shared. This therefore calls for a "Whole-of-Government" approach to dealing with issues of environmental pollution (Robinson, 2014), particularly from mining.

Chapter Summary

This chapter showed how decentralisation could be useful in curbing environmental pollution by using system dynamics to first understand the relationships within the variables used. SD brought out the quantitative data through the use of simulations in depicting how such a policy measure would perform once implemented. Even though SD models are used widely in other areas of public life, it is rarely used in government policy making (Wheat, 2010). Ultimately, a dynamic performance management approach showed how the information from the interviews and observations was coded. It brought out the elements of co-ordination and the design of decentralisation as a policy measure and how this would affect the horizontal and vertical levels of public administration.

Besides decentralisation, other policy measures that policy makers could implement would be to employ civic organisations as agents of change especially where formal regulation is weak. Government institutions and departments could also make environmental sustainability a cross cutting issue, creating a conjecture where on one hand, information sharing would be much easier since all ministries and government institutions would form technical teams, while on the otherhand, resources among the various government departments would be shared, which would filter through to environmental agencies.

CHAPTER 6   CONCLUSION

6.0 Introduction

The decentralisation of environmental issues has the potential to lead to a more efficient and transparent public service. Governments globally are compelled to provide efficiency and accountability in the delivery of public services. One of the governance measures within the NPM reforms is decentralisation. However, the NPM reforms have not had the same impact all over the world. While countries such as New Zealand and Botswana have successfully implemented management reforms, this is not the case for Zambia. Decentralisation, though now embedded in the national constitution, has not been fully implemented, a situation that has brought challenges to dealing with environmental pollution from mining activities.

The aim of this research was to explore and show how two systems- a system dynamics approach and a dynamic performance management approach, could be used in dealing with pollution maters. To address this aim, three objectives guided the study.

6.1 Summary of study

The findings indicated that air pollution from mining is a problem that has not been addressed adequately due to the lack of appreciation by policy makers. While legislation has been put in place, there are still a lot of challenges faced by the various stakeholders. In addition, it was observed that the pieces of legislation are not in line with each other. For instance, there are disparities and gaps in the EMA and the Mines and Minerals Act, where the responsible ministers are given powers to decide on serious cases when the rich mining companies come into question.

The SD model showed the problem of air pollution and how decentralisation could be used to curb it. It also showed how institutions such as ZEMA and the local municipalities can employ this using the stocks and flows.

In the DPM approach, the key element of decentralisation was shown at the institutional and inter-institutional level. While the local levels are not designing and executing policies on mine pollution independently, there was a massive need for co-ordination at both the horizontal and vertical levels.

6.2 Contribution to the field of study

The study has added a body of knowledge to what is not available concerning the use of SD and DPM as approaches in dealing with environmental pollution from mining through decentralisation. It showed that public policies often fail to achieve their intended result because of the complexity in the policy making process. The study showed, though, that decentralisation, as an apparatus in governance, can present fundamental shifts in the institutional change of the public service in Zambia, in helping to deal with environmental problems. However, this can only be achieved if there is a commitment to apply it fully.

6.3 Conclusion

Societies are characterised by the dynamic complexity of what has been termed as ''wicked problems' (Bovaird and Loffler, 2003) whose solutions cannot be found. Hence, wicked problems such as environmental pollution need an involvement of a multi-level, multi actor and multi sector approach (Bianchi, 2016).

Pollution from mining activities is a serious problem in Zambia and the world over. The paradox, however, is in how transparent institutions dealing with such matters are willing to go, especially where there are more economic gains to be made from mining activities. Clearly, decentralisation could be used for such matters, but there is a strong need to consider the different and changing national contexts, external pressures as well as the political situations in order to organise an effective and active administrative sector. There is need to identify and reconcile the point that matters of the environment work best by merging vertical structures of authority with the horizontal structures.

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