

SMALL SCALE CHROME MINING CO-OPERATIVES
IN ZIMBABWE AND THEIR RELEVANCE
TO THE NATIONAL ECONOMY

by

Charles D. G. Chipato

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A thesis submitted to the Faculty and the Board of Trustees of the Colorado School of Mines in partial fulfillment of the requirements for the degree of Master of Science (Mineral Economics).

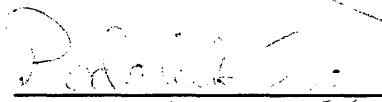
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ABSTRACT

Mining co-operatives, the brainchild of a few public spirited citizens in Zimbabwe, have been in existence only since 1982. They were first viewed as a waste of time by a very conservative mining community, but are now recognized as an important supply source of ore for the chrome smelters in Zimbabwe. During the accounting period July 1986 to June 1987 they achieved a record 80,592 metric tonnes of chrome ore valued at Z\$6,074,750, up 113% from the previous year's figure.

This study analyzes the nature of chrome co-operatives in Zimbabwe and the role of co-operatives in the country's development. It analyzes some of the important characteristics of co-operatives and the extent to which they are assets or liabilities. It is an attempt to explain to Zimbabwe's mining community some of the positive attributes of the co-operative movement and how these attributes can be enhanced to maximize the role of co-operatives in Zimbabwe's development.

A discounted cash flow analysis is performed to evaluate economic viability. A sensitivity analysis follows in an attempt to investigate how variations in some of the parameters pertinent to the co-operative movement affect profitability. This analysis identifies

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price as one of the variables that might threaten the co-operative movement in the event of a drastic downturn in demand.

The study concludes that the benefits of co-operatives to Zimbabwe (in the form of employment, regional economic development, and earnings that remain in the country) justify government policies to promote and encourage the development of co-operatives. In other words, the benefits to society of government support to an industry that would not exist without support exceed the costs of this assistance.

The study also concludes that the government is making efforts to create a policy and institutional framework conducive to the development of co-operatives.

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Chapter 1

INTRODUCTION

1.1 Motivation for Study

Mining co-operatives are a relatively new phenomenon in Zimbabwe and their potential contribution to the national economy is yet to be fully exploited. With a tendency in most African countries to give prominence to the contribution of large-scale operations (Halloway, 1986), there is a danger that co-operatives may not receive government protection and encouragement during their infancy. The move to co-operatives in Zimbabwe began after independence in 1980 and represents a departure from the country's traditional small-scale mining ventures. Many more people are involved usually between 50 to 150, unlike the small-scale gold mines, for instance, that are operated by individual owners. They therefore require a different organizational structure. There is a definite need to examine their nature and role in national development in order to maximize their contribution.

1.2 Purpose

This study will identify some of the important attributes of the co-operative movement in Zimbabwe, relate them to national development, and investigate the extent to which the

policy and institutional framework within which the co-operatives operate enhances their role in development. The thesis will also attempt to investigate the viability of the co-operatives and their sensitivity to parameters such as price, costs, taxation, and production.

1.3 Background

The idea of mining co-operatives emerged in 1982, motivated by a government policy aimed at creating employment in the rural areas. In 1982 a series of seminars organized by public-spirited citizens and sponsored by the Australian Embassy were conducted at various rural locations in Zimbabwe, the purpose being to interest the residents in the technicalities of mining and the rewards. Initially the enthusiasm was limited; most of the talks were too technical. Through the perseverance of the sponsors, a Small Miners Association was formed to encourage individuals who might be interested in a mining venture (Phimister, et al., 1987).

By June 1987 the number of chrome co-operatives stood at 28, an increase of 55% over 1986. During the same accounting period, chrome co-operatives sold 80,592 metric tonnes of ore valued at Z\$6,074,750.00 (a Zimbabwe dollar is approximately 0.6 of a U.S. dollar), an increase of 189% over the previous sales figure (Zimbabwe Mining Development Corporation Annual

Report on Co-operatives, 1987). Obviously the co-operative movement is gaining ground, a good point at which to examine their operations, ascertain the extent of their contribution to national development, and determine what other measures are necessary to enhance that contribution.

1.4 Scope

Chapter 2 will examine some of the characteristics of co-operatives and their implications for national development. Some of the issues are market environment, deposit utilization, employment and social impact, environmental concerns, efficiency, health and safety, finance, entrepreneurship and business development, management and organizational structure, and the institutional and policy framework.

Chapter 3 will examine measures that are being taken in order to enhance the role of co-operatives in national development. Among the issues this chapter will focus on are the importance of introducing training schemes, the role of mining regulations in effecting proper control of operations, stabilizing measures in the event of drastic demand variations, and the need to improve the performance of the intermediate institution responsible for the promotion of co-operative mining ventures, the Zimbabwe Mining Development Corporation (ZMDC).

Chapter 4 will investigate the viability of co-operatives through a discounted cash flow analysis of the Ngesi co-operative, one of the first co-operative-type mining ventures established on the Great Dyke after some one hundred employees had been laid off by the Ore Recovery Company, a firm that had been exploiting chromite over a ten -mile long strike in the Ngesi area using load-haul-dump equipment. The company stopped operations after reaching a depth of about 20 feet (considered the maximum viable depth under the prevailing conditions). In many ways this co-operative is representative of the typical co-operative in that it possesses most of the attributes associated with co-operatives, operates in the same type of institutional and policy framework and is located in the Great Dyke with most of the other co-operatives, and has the same type of mineralization as the majority of co-operatives. Data for this analysis is based on a three-year period during which the Department of Mining Engineering in the Ministry of Mines monitored the costs and revenues of this operation. The study is however done over a five-year period. Data for the extra two years are estimates based on assumptions. The analysis aims at establishing a constant 1980 dollar rate of return (ROR) and net present value for the project in order to reflect the return in terms of a constant purchasing power since independence.

The sensitivity analysis in chapter 5 examines the project's sensitivity to variables such as price, production, taxes, and escalation. The chapter also establishes (1) a pessimistic, (2) optimistic, and (3) a most likely level of operation for the project. This is an attempt to establish limits within which to view the viability of the project.

Chapter 6 in concluding will recapitulate on the issues discussed in the previous four chapters. The chapter will also comment on some of the limits or shortcomings of this study.

Chapter 2
ATTRIBUTES OF CO-OPERATIVES AND IMPLICATIONS
FOR DEVELOPMENT

2.1 Introduction

The chromite deposits in Zimbabwe occur along the entire length of the Great Dyke and are both stratiform and podiform in nature. Stratiform deposits, the kind mainly exploited by the co-operatives, occur in layers of up to several feet, are of fairly uniform composition and extend over large areas (Mineral Facts and Problems, 1986). The co-operatives usually target the very shallow deposits and exploit layers of up to 3.5 feet. The traditional method of exploitation has generally been pigrooting the chromite seams using picks and shovels from shallow trenches. Though this has the advantage of requiring unsophisticated mining techniques and equipment the method can become unsafe (if the trenches become too deep they can collapse) and the heavy summer rains can disrupt production.

Traditionally an oligopoly has characterized the chromite production market in Zimbabwe with the Zimbabwe Mining and Smelting Company (Zimasco) acting as the dominant firm. The entrance of the co-operatives changed the structure slightly, as will be explained later, with

possible adverse effects on the co-operatives in the event of a sudden downturn in demand.

Like most developing countries, Zimbabwe's development policy emphasizes rural development. Among some of the arguments for advocating such a policy is the desire to arrest migration to urban areas. Mining co-operatives represent a segment of the mineral extractive sector with a high potential for realizing the objectives of this policy. In this chapter some of the attributes of chrome co-operatives in Zimbabwe, both beneficial and detrimental towards the achievement of the above policy objectives, are discussed and the implications to development analyzed.

2.2 The Market Environment

Until 1982 only three companies were involved in chromite production in Zimbabwe, namely Rio Tinto, Zimasco, and Zimbabwe Alloys (Zimalloys). By 1983 Rio Tinto had exited and the latter two continued mining in order to provide ore for their smelters at Kwe Kwe and Gweru respectively (the only two in the country). Since all the chrome in Zimbabwe is smelted prior to export, Zimalloys and Zimasco constitute all the demand for chromite ore in the country. The co-operatives sell to these companies at a price negotiated by all the parties

concerned. Since Zimasco and Zimalloys also produce their own chrome, they dominate in the establishment of a price. The situation might be described as a collusive duopsony on the part of the two giant companies.

If we consider the two companies as a monopsony with production function:

$$q = h(x) \quad (2.1)$$

where x is the quantity of input from the co-operatives, the revenue and cost functions of the monopsony are

$$R = pq, \quad C = rx$$

where r is the price of the input from the co-operatives and is an increasing function of x :

$$r = g(x) \quad (2.2)$$

The profit equation of the monopsony is therefore:

$$p_i = R - C = ph(x) - xg(x) \quad (2.3)$$

where p_i is the profit.

Setting the derivative of the above equation equal to zero gives us the first order conditions for profit maximization:

$$pdh/dx = r + xdg/dx$$

where dh/dx and dg/dx are partial derivatives of h and g with respect to x , respectively. The first order conditions require that the input from the co-operatives be employed to a point that the value of its marginal product equals its

marginal cost. Solution of the first order conditions equation 2.3 for x and substitution into equations 2.1 and 2.2 will give the quantity and price at which the monopsony will buy from the co-operatives. Generally the monopsony will tend to purchase a smaller quantity at a lower price than in a competitive market. Figure 2.1 illustrates how the monopsony sets its price and quantity. The quantity x^0 is determined by the intersection of the marginal cost curve dC/dx and the marginal product curve pdq/dx . The price r^0 is then established by the curve $g(x)$ (the supply function of the monopsony). The equality of the price of the quantity with its marginal product would result in $r^{(1)}$ and $x^{(1)}$ being the price and quantity respectively in a competitive market.

The implication of this type of market is that since the monopsony has a tendency to purchase less at a lower price, in times of demand downturn, the viability of the co-operatives might be threatened. Like most mineral commodities, demand for chrome in Zimbabwe is cyclical as shown in figure 2.2 and there is a possibility that in the future demand might pose a threat to the profitability of the co-operatives.

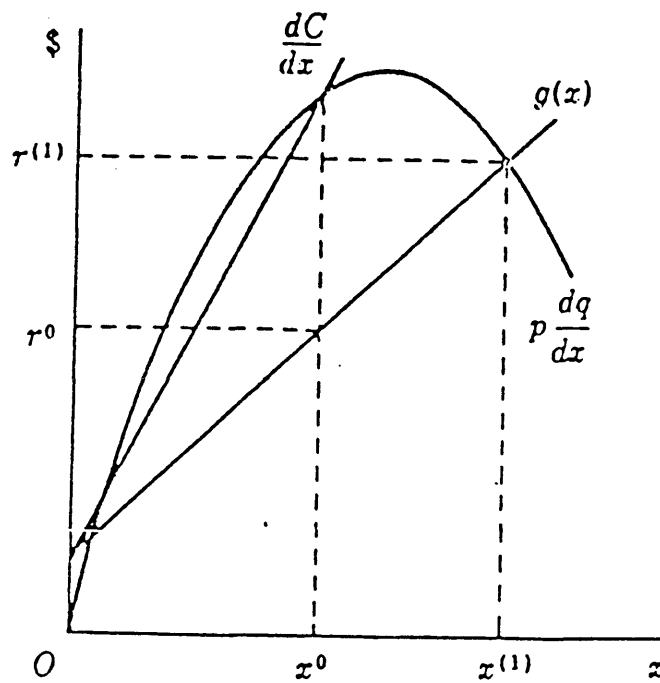


FIGURE 2.1

Monopsony Setting Quantity and Price

Source: Henderson and Quandt. 1980. Microeconomic Theory, A Mathematical Approach. New York, McGraw Hill.

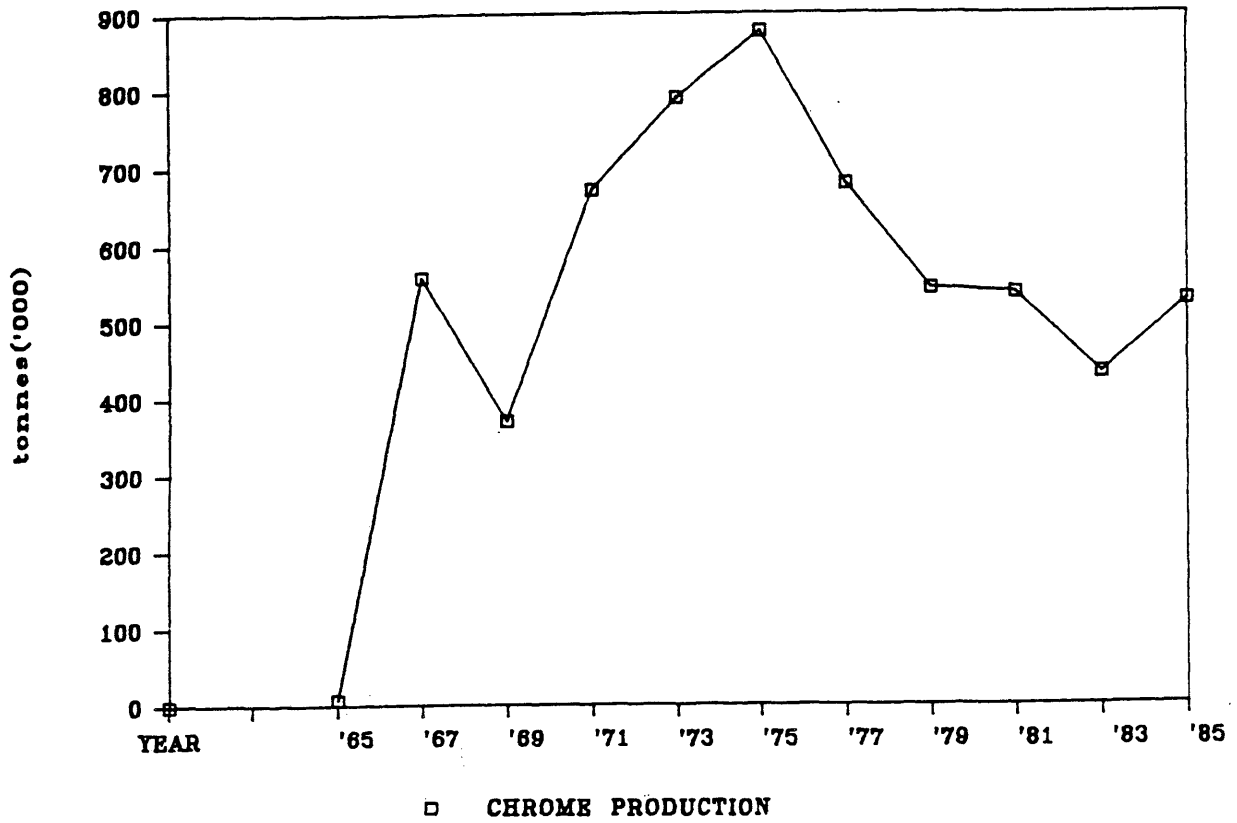


Figure 2.2

Cyclical Nature of Demand for Chrome Ore in Zimbabwe

Source: Zimbabwe Central Statistical Office. Quarterly Digest of Statistics, 1987. Harare: Zimbabwe Government

2.3 Deposit Utilization

Small-scale mining is generally associated with poor utilization of natural resources because the tendency is to mine only the high grade ores. This is perhaps one of the major criticisms of small-scale operations. The primitive nature of small-scale mining methods as well as the desire to realize quick returns are the principal reasons for highgrading. The problem can be cause for concern, particularly when there are alternative ways of extracting the deposit. In Bolivia, only 50% tin recovery is realized after concentration because of the primitive methods used by small scale-miners (Arce, 1978).

In Zimbabwe the problem of highgrading among the chrome co-operatives is less worrisome because of the uniform nature of the deposits and the fact that the deposits would not be exploited at all if it were not for small-scale operations. The return on capital for a large operator (taking cognizance of the higher minimum wages that government requires large-scale operators to pay their employees) is not acceptable because the ore bodies are small. In general, the ill effects of highgrading are usually more than counter-balanced by the benefits. Noetstaller (1987) summarizes the problem of deposit utilization by small-scale miners thus:

While the extreme form of highgrading is without doubt economically undesirable, there is reason to believe that both its damaging effects and its extent in small scale mining is overestimated. . . . On the other side, numerous mineral deposits with complicated geometric conditions and limited resources can only be extracted by small operations. These resources would remain unutilized unless they were exploited by small mines. . . . Comparative observations of this nature lead to the conclusion that in total the positive effects of the utilization of marginal natural resources through small scale mining far outweighs the damage done by localized or occasional highgrading.

The problem of deposit utilization, however, is one which the government has to monitor constantly because, as the the number of small-scale operators increases, there is the possibility fragmentation of ore bodies of a size and nature exploitable by large-scale operations.

2.4 Employment and Social Impact

The mining-co-operatives appear to have helped arrest the exodus of people from the rural areas. Small-scale mining ventures in most developing countries are highly labor intensive. Table 2.1 illustrates the employment attributable to small-scale mining operations in nine developing countries.

In underground mining, employment per unit output can differ by a factor of 30 between mines using traditional artisanal methods and those using highly mechanized operations (Noetstaller, 1987).

Table 2.1
Employment Generated by Small-Scale Mines

| Country | Persons Employed Small-Scale Mines | Percentage of Mining Sector Employment |
|-------------|---------------------------------------|---|
| Bolivia | 23,800 | 30 |
| Chile | 11,000 | 15 |
| India | n.a. | 47 |
| Mexico | 25-30,000 | 20-22 |
| Morocco | 39,400 | 40-50 |
| Peru | 40,000 | 50 |
| Phillipines | 200,000 | 78 |
| Rwanda | 11,000 | n.a. |
| Zaire | 20-50,000 | 20-35 |

Source: Richard Noetstaller. 1987 Small Scale Mining: A Review of the Issues. Washington D.C.: World Bank.

In Zimbabwe, the evidence is that chrome co-operatives play an important role in the generation of rural employment. Because of the newness of the co-operatives it is difficult to compare them with Zimbabwe's large- and medium-sized chrome mines. Table 2.2 attempts to do this by comparing the labor intensity, measured as labor per ton of production, of the chrome sector for years 1982 through 1984 with that for co-operatives for years 1986 and 1987. Despite the scarcity of data, it is evident that the labor intensity of co-operative is greater than the large and medium operations by a factor of at least 29. It is pertinent to note that the labor intensity of the traditional large and medium mines has dropped dramatically since 1982. Figure 2.3 is based on figures on tonnages and labor complements in the chrome sector. There is a possibility that a lot of the workers who joined the co-operatives were from the larger mines.

Though the small-scale mining segment does not offer the same standard of social welfare as the large operations, it plays an important role in improving the standard of living in the rural areas of developing countries. Owayo (1978) describes the social impact of ruby mining in the Taita-Taveta area of Kenya:

In 1973, when the ruby rush started, Voi, a gemstone trading centre, was a small town on the

Table 2.2

Labor Intensity (Workers per Metric Ton of Production)
in Zimbabwe's Chrome Mines

| <u>YEAR</u> | <u>No. of Workers</u> | <u>Production (metric tonnes)</u> | <u>Labor Intensity</u> |
|-------------|---------------------------|---------------------------------------|----------------------------|
| 1982 (L.S.) | 4,299 | 431,600 | 0.0099 |
| (Co-op) | * | * | * |
| 1983 (L.S.) | 1,812 | 431,400 | 0.0042 |
| (Co-op) | * | * | * |
| 1984 (L.S.) | 1,842 | 476,400 | 0.0039 |
| (Co-op) | * | * | * |
| 1985 (L.S.) | * | 526,500 | * |
| (Co-op) | * | * | * |
| 1986 (L.S.) | * | * | * |
| (Co-op) | 1,450 | 37,800 | 0.038 |
| 1987 (L.S.) | * | * | * |
| (Co-op) | 2,318 | 80,592 | 0.029 |

Note: L.S. = Large-Scale; Co-op = Co-operatives.

* Data not available for that year.

Source: (1) ZMDC Annual Report on Co-operatives for period July 1986 to June 1987.

(2) Zimbabwe Central Statistical Office, 1984/85

The Census of Production. Harare: Zimbabwe Govt.

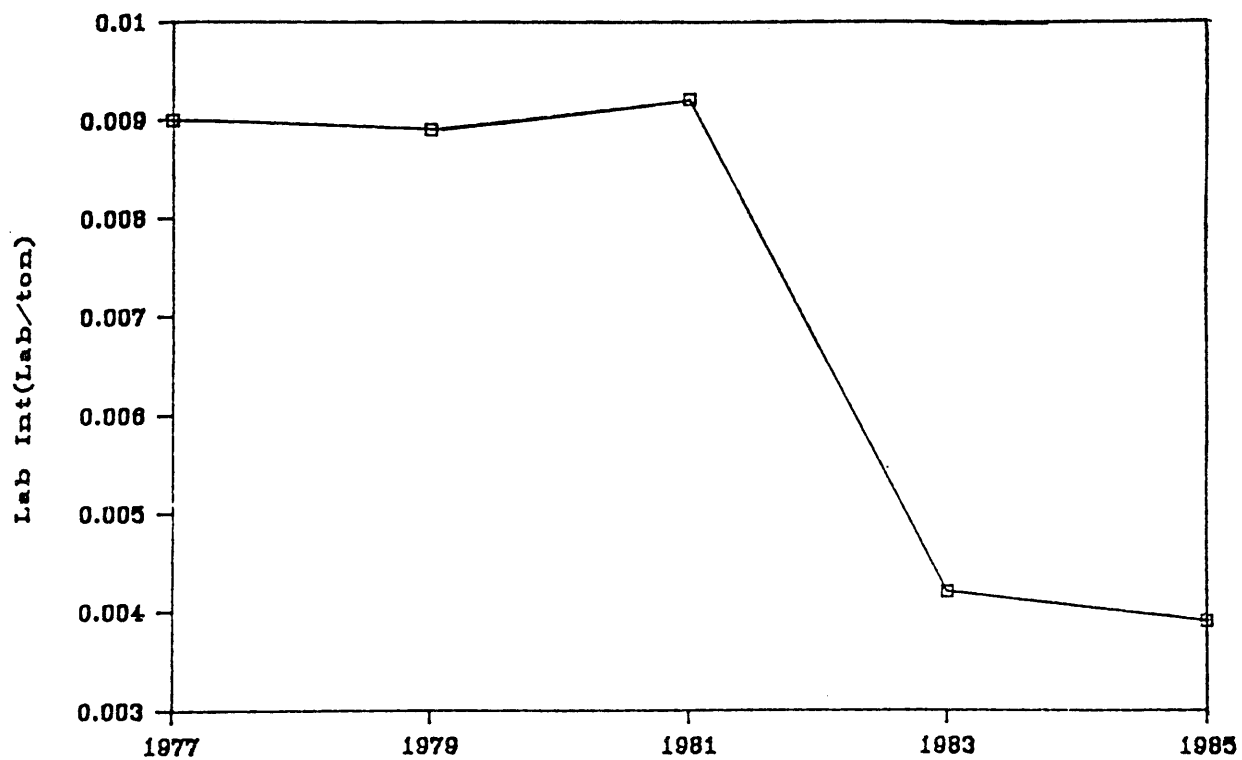


Figure 2.3

Trend of Labor Intensity in Zimbabwe's Large-
and Medium-Sized Mines

Source: Based on data from Census of Production-1984/5
Zimbabwe Central Statistical Office. Harare:
Zimbabwe Government.

road to Mombasa. Today, the centre has seen tremendous growth. . . . Population increased tremendously coupled with improvements in medical, educational and other facilities.

The co-operatives in Zimbabwe have not reached the stage where some of the above benefits are conspicuously evident, but there are promising signs. The ZMDC Annual Report on Co-operatives, 1987 reports:

It is gratifying to record that the co-operatives at Lalapanzi did, on their own initiative start paying for Group Life Insurance/ Pension schemes with Old Mutual. The trend seems to be spreading to the North Dyke where individual members of some co-operatives are as a result of their improved financial situation, taking out insurance policies.

Some of the co-operatives formed in 1982, such as the Ngesi, already have populations of about 1,000 and facilities such as a school and a shop. Apart from the social benefits, small-scale mining in general offers excellent opportunities for upgrading unskilled labor into semi-skilled or skilled.

2.5 Environmental Concerns

Environmental concerns hardly exist in the small-scale mining areas of most developing countries because operations are small and locations are isolated. In the case of the chrome co-operatives, the primary concern is to ensure that backfilling operations are undertaken after

the co-operatives have extracted the ore from the trenches. Regulations of the Ministry of Natural Resources and Tourism require this.

2.6 Income Generation

Although sales from co-operatives are small, a larger proportion of revenue from sales is returned to Zimbabwe citizens than from large operations. To measure the extent of the contribution, one needs to relate income generation to GDP or GNP. It is extremely difficult to estimate the amount of disposable income that small-scale operations contribute towards GDP because of lack of statistics. More so for the co-operatives in Zimbabwe because, being a fairly new subsector, their accounting methods are rudimentary and unreliable.

Small-scale operations are able to contribute a much larger percentage of disposable income than large and medium operations. Stewart (1987) based his calculations of disposable income for small-scale operations on data of payments made to small-scale operators in the Wau-Bulolo area of Papua New Guinea. A comparison of his findings to the contribution of the large operations is shown below. The combined contribution of disposable income of Bougainville Copper Ltd and Ok Tedi Mining Company towards

GDP is 50.63% of the contribution of the small-scale miners..

Table 2.3

Comparative Benefit to Papua New Guinea from
Foreign-owned Mining Operations and
Small-Scale Miners

| | <u>Disposable Income</u> <u>(% of GDP)</u> | <u>Public Sector</u> <u>Income (% of GDP)</u> |
|--------------------|---|--|
| Bougainville | 14.30 | 36.1 |
| Ok-Tedi | 21.40 | 3.0 |
| Small-Scale Miners | 70.50 | 13.9 |

NB: Data for Bougainville are 1973 and the rest are for 1982. Addition does not reflect total for one year.

Source: D. F. Stewart 1987 "Small Scale Mining and Development: The case of Gold Mining in Papua New Guinea" Natural Resources Forum, Vol 11, No 3.

Stewart summarizes the extent of contribution of small-scale operations in Papua New Guinea thus:

Data for that year (1982) show that neither for a mine in operation (Bougainville) nor for one in the construction phase (Ok-Tedi), which is typically the period when a mining development makes its largest contribution to the incomes of citizens, does the proportion of the contribution towards GDP going to the nationals approach that from small-scale mining.

This thesis attempts to make a similar comparison for Zimbabwe based on data on chromite production in the

Census of Production, (1984/85), and the production of the co-operatives for 1986 and 1987 in the ZMDC Annual Report on Co-operatives, (1987). The documents mentioned above are shown in appendices A and B. Table 2.4, which also makes comparison in terms of the percentage of revenue earned, is not very informative as to the contribution of disposable income towards GDP, because of unavailability of data for some of the years. The disposable income in the table is a reflection of the wages paid to the co-operatives and employees of the large-scale operators. The figures for the co-operatives are more realistic because they do not pay taxes and all their wages are disposable. If the 1986 figure of 0.013% contribution from the co-operatives is anything to go by, that contribution is currently very small. The figures, however, show that as a percentage of revenue earned, the co-operatives' contribution is more than that of the large-scale operators. This situation exists because small-scale operators require less capital investment and hence less capital repayments and return to capital. Another factor is that a large proportion of the equity in large-scale operations is held by foreign countries.

Table 2.4
 Contribution of Disposable Income for Large-
 Scale Operations and Co-operatives

| <u>Year</u> | <u>Sector</u> | <u>Revenue</u> | <u>Income</u> | Dispos Income (%) <u>Revenue)</u> | Dispos Income <u>(% GDP)</u> |
|-------------|---------------|----------------|---------------|---|------------------------------------|
| 1983 | L.S. | 20,601,000 | 5,866,000 | 28.47 | 0.11 |
| | Co-op | * | * | * | * |
| 1984 | L.S. | 21,893,000 | 5,917,000 | 27.02 | 0.099 |
| | Co-op | * | * | * | * |
| 1986 | L.S. | * | * | * | * |
| | Co-op | 2,100,000 | 1,100,000 | 53.30 | 0.013 |
| 1987 | L.S. | * | * | * | * |
| | Co-op | 6,074,750 | 3,267,585 | 53.80 | * |

Note: Dispos Income = Disposable Income (wages paid to employees); L.S. = large-Scale; Co-op = Co-operatives; Figures of Revenue and Disposable Income are in Zimbabwe Dollars.

Source: ZMDC Report on Co-operatives for period July 1986 to June 1987. Harare: ZMDC.

Zimbabwe Central Statistical Office, Census of Production. Harare: Zimbabwe Government.

2.5 Capital Intensity and Finance

Because small-scale operations employ mining methods with little mechanization, their capital intensity is considerably lower than that of the large scale operations. Richard Noetstaller (1987) illustrates this by drawing on the experience of multinational lending institutions in Mexico:

[I]n 1980 median investment cost per new job created was estimated to be US\$7,000 for small scale mines and US\$12,000 for medium scale mines. In 1985, average capital investment cost per job created in the Mexican mining sector was US\$10,000-30,000 for small scale mining as compared to US\$100,000-200,000 in the large scale mines.

Table 2.5 makes it evident that the amount of capital investment per metric ton of annual output necessary for mining facilities is very high. This is because most large-scale mining facilities are frequently required to bear a substantial part of the infrastructure costs, especially in developing countries. Considering the difficulty most developing countries face in acquiring the necessary capital for investment into the minerals sector because of short-term changes in the business cycle (Tilton, 1977) the low capital intensity of small-scale operations is indeed an important attribute. When there is a downturn in demand, mineral-producing firms tend to generate less profit, hence shrinking internally generated

Table 2.5
 Typical Capital Investment Requirements for
 Mining and Processing Facilities

| <u>Mineral and Facility</u> | <u>Capital Investment Per Metric Ton of Annual Output (U.S.Dollars)</u> |
|--|---|
| ALUMINUM: | |
| Bauxite Mining | 25-30 |
| Aluminum Refinery | 200-300 |
| Aluminum Smelting | 1,000-1,500 |
| COPPER: | |
| Mining, Beneficiation, Smelting and Refining | 3,000-5,000 |
| LEAD: | |
| Smelter Expansion | 100-500 |
| NICKEL: | |
| Mining and Smelting | 8,000-15,000 |
| ZINC: | |
| Blast Furnace and Electrolytic Refinery Expansion | 300-700 |

Source: Rex Bosson and Bension Varon. 1978. The Mining Industry and the Developing Countries. Washington D.C.: Oxford University Press.

funds for investment. The ultimate effect in the long run is to lag behind investment needs.

The mining co-operatives in Zimbabwe are, by most classifications, very small-scale. The only representative measure of their capital intensity is the Ngesi mine which was monitored by the Ministry of Mines over a period of three years. The mine was designed for an output of 2,400 tons per annum and the initial capital necessary to reach production stage amounted to Z\$30,567.50. This would approximately translate to US\$18,340, indicative of a capital intensity of US\$7.60 per metric ton of annual production, considerably lower than the figures in Table 2.5.

In spite of the low investment costs associated with small-scale operations, finance is one of the main constraints in the development of this sector. The main reason why small-scale operators have been largely precluded from the commercial credit market is that they are perceived as having a high risk level in the absence of an acceptable collateral, difficulties of assessing their markets, and the high cost of administering small loans. This constraint is acknowledged in most developing countries with a significant small-scale mining sector. (Arce, 1978) in making recommendations for vitalizing

small-scale mining in Bolivia comments:

The Banco Minero should be reorganized and capitalized so that it can fulfill the aim of which it was established. The loans which it grants to the latter [small-scale miners] should be duly supervised, and no collateral guarantees should be required.

The Zimbabwe government, in recognition of this problem has established within the Ministry of Mines, the Mining Industry Loan Fund that provides assistance to mines, particularly small operators. An important feature of this fund is the Plant Hire Scheme, administered by the Office of the Chief Government Mining Engineer. The scheme purchases most of the equipment that the small operator normally requires and provides it to the operators on a hire-to-buy basis over periods of between one and three years. Monthly hire charges include interest at the rate of 10% per year (Halloway, 1986). There is no collateral requirement, and application for plant hire is accepted subject to a Regional Mining Engineer's assessment of the need for that plant.

2.8 Management and Organizational Structure

The Co-operative By-laws, included as appendix C, incorporate the objectives of the co-operatives as well as define organizational structure. The nature of the

organizational structure of co-operatives is ill-suited to perform management functions effectively. Managers usually lack education or experience in management and run their enterprises in a casual fashion.

The following section of the by-laws defines the managing committee of the co-operative:

i) The committee shall in addition to ex-officio members of the society, over the age of eighteen years, have a Chairman, who shall be Chairman of the co-operative and the General Meeting, a Vice Chairman, a Secretary and Vice Secretary, Treasurer and . . . Committee members.

The tendency among the co-operatives has been to consider this committee, acting in a plural executive capacity, as the management of their enterprises. Apart from the obvious disadvantage of lacking the necessary mining know how, committees are generally less efficient in decision making because of the need for compromise. As Hodgetts (1986) points out, people in management must recognize times when committees do not perform as well as individual managers.

The nature of their organization structure is sometimes in conflict with the government's mining (Management and Safety) regulations that require the appointment of a single competent manager who has the approval of the Chief Government Mining Engineer. Below are the relevant sections of the Mining (Management and

Safety) Regulations 1981:

section 3(1) Every mine shall be under the management, control and direction of a manager appointed in terms of the regulations.

section 3(2) No mining or allied operations shall be carried on at a mine for a period exceeding seven days unless a manager has been appointed for that mine in terms of the regulations.

section 5(3) If the Chief Government Mining Engineer, after consultation with an inspector, is not satisfied, having regards to the nature of the mining operations being conducted on a mine, that the person appointed as the manager of that mine in terms of the regulations. . .

(b) . . .has sufficient knowledge, experience and ability to be the manager of the mine, he may in writing notify the person who made the appointment accordingly and require him to appoint someone else as the manager of the mine.

The Chief Government Mining Engineer has tended to be accommodating in the implementation of certain sections of these regulations, but this cannot be expected to continue.

Because they do not know how to run their operations, most co-operatives are unable to make financial plans capable of achieving growth in the long term. Fortunately the government realized this incapacity and delegated this responsibility to the Zimbabwe Mining Development Corporation (ZMDC). ZMDC has a Co-operatives Division

under it, responsible for promoting co-operatives as well as running their financial affairs.

2.9 Health and Safety

Unmechanized mining is arduous. Coupled with the lack of worker skills it can be dangerous. Both from a humanitarian and an economic point of view, acceptable standards of health and safety have to be provided at all mines regardless of size. Small-scale operations have a poor safety record. The most common mine accident associated with the co-operatives in Zimbabwe are falls of ground. Because of inexperience and a desire to realize as much production as possible, co-operatives build roofs and sidewalls of their workings that are inadequate.

The government tries to enforce proper safety standards through the mining (Management and Safety) regulations, but lacks the manpower for proper enforcement. The situation has not yet reached alarming proportions because most current operations are surface operations. As underground operations increase, the problem of safety will require greater attention.

2.10 Entrepreneurship and Business Development

Unlike the large-scale mining sector, the small-scale mining sector is fertile ground for the development of

indigenous entrepreneurship because barriers to entry in terms of capital needs and formal education requirements are considerably lower. The skills necessary for the exploitation of deposits associated with small-scale mining are minimal; the smaller the mine, the closer the mineral is to surface and the simpler the method of extraction.

Another important aspect in this context is the short time necessary to bring small-scale mines into production. A typical co-operative in Zimbabwe can be brought into operation almost immediately for surface operations and about six months for underground operations. Large-scale operations require 5 to 8 years of development work before production starts.

2.11 Comments

The chrome production market is characterized by a demand that is a collusive monopsony buying from a group of co-operatives operating in a competitive environment. The dangers with this type of market environment are the tendency of the demand to buy less at a smaller price than a competitive situation.

Beneficial attributes of the co-operatives are the following:

(a) A high labor intensity with potential to generate employment in the rural areas and arrest migration to urban areas.

(b) A low capital intensity making entry easier.

(c) A potential for a significant contribution towards GDP in terms of disposable income.

Negative aspects of co-operative mining include poor deposit utilization, difficulties in acquiring capital, unsatisfactory health and safety standards, and poor management and organizational structures.

Despite a host of positive attributes, small-scale mining still faces constraints and barriers. Healthy development of the sector is to a large extent dependent on external assistance, and in this context the role of government policy initiatives is important.

Chapter 3
POLICIES, INSTITUTIONS, AND MANAGEMENT

3.1 Introduction

Two distinct characteristics of small-scale mining in and co-operatives in particular are a strong potential to generate social and economic benefits in a developing country such as Zimbabwe and the existence of constraints and barriers towards the development of this sector. The obvious strategy for strengthening the role of co-operatives is to adopt a two-pronged approach:

(a) remove the constraints associated with the development of this sector.

(b) adopt measures that will enhance the impact of their positive attributes.

This chapter will investigate how policies, relevant institutions in the country, and management of the co-operatives enhance their role in development. Wherever possible, the investigation will draw on experiences from other countries and will look at measures such as the need for stabilization in the event of a downturn in demand, legislation to avoid improper utilization of deposits, health and safety regulations that are simple and clear to ensure effective implementation, management requirements,

the importance of training, and the need for an effective intermediate institution to promote and guide co-operatives.

3.2 Policy and Institutional Measures

Most of the constraints identified earlier cannot be overcome by the co-operatives on their own. Prior to the entrance of the co-operatives, policy and legislation was geared towards the development of large-scale operations. There is currently a move towards modifying policy and legislation wherever the need for such modification is identified. Some aspects of policy and institutional framework pertinent to the co-operative movement are discussed below.

3.2.1 Taxation

The determination of appropriate taxation for any enterprise is important since taxes often determine whether an enterprise will survive. Taxes also have implications for resource utilization, often influencing the cut-off grade. The latter implication has minimal relevance to co-operatives since the deposits they exploit are reputed to be of fairly consistent grades (Phimister, et al., 1987). The significance of the cost nature of

taxes will be shown in chapter 5.

In Zimbabwe corporate taxes are set at an effective rate of 51.75% of net income. Other taxes include a 15% tax on consumables, a 5% import duty on mining equipment, a 15% import tax, and a 15% surtax. Dividends are subject to a 20% nonresident shareholder tax, (Noetstaller, 1987). If the co-operatives had to shoulder all the above taxes, it is unlikely that they would break even.

The Zimbabwean government, in recognition of this constraint, has waived taxation on co-operatives up to a net income of Z\$15,000 per year. This is a substantial tax exemption of their surplus. Table 3.1 shows the production of some 22 co-operatives in 1986. It appears that their production generally realizes revenues between Z\$40,000 and Z\$200,000. Assuming a profit margin of 15%, fairly reasonable if one examines a representative cost structure of the Ngesi Co-operative shown in a later chapter, most of the co-operatives in table 3.1 would have received substantial exemption.

The co-operatives generally do not bear most of the taxes associated with imports of mining machinery since they acquire most of their equipment through the Plant Hire Scheme. All the equipment under this scheme is imported by the Ministry of Mines. Since government

Table 3.1

Chrome Mining Co-operatives in Zimbabwe

| <u>Name</u> | <u>Workforce</u> | <u>1986 Production</u> | <u>Total Value</u> |
|-----------------|------------------|------------------------|--------------------|
| Bhibho | 125 | 2,831.00 | 213,031.00 |
| Chemakomo | 60 | 2,489.20 | 152,914.00 |
| Dzikamidzi | 40 | 506.70 | 44,174.68 |
| Chinokura | 55 | 735.30 | 75,956.49 |
| Gare Tangenhamo | 65 | 1,513.00 | 115,685.00 |
| Kaguvi | 55 | 1,249.00 | 94,093.00 |
| Muzare | 55 | 1,224.00 | 96,930.00 |
| Nhamo | 50 | 1,127.50 | 116,160.00 |
| Nherera | 65 | 1,656.40 | 97,306.00 |
| Ntamoyata | 70 | 1,361.30 | 127,291.99 |
| Nyikandeyedu | 145 | 2,715.60 | 174,368.05 |
| Power | 75 | 1,148.70 | 134,421.97 |
| Rod Camp | 50 | 1,929.50 | 121,033.87 |
| Rugare | 75 | 1,520.00 | 114,369.00 |
| Shumba | 50 | 748.60 | 74,300.38 |
| Shungu | 55 | 1,232.00 | 94,093.00 |
| Taisireva | 55 | 645.50 | 66,680.00 |
| Tavakuenda | 110 | 3,206.00 | 233,233.00 |
| Tichatonga | 65 | 2,149.20 | 123,356.40 |
| Tinei | 50 | 523.20 | 54,045.56 |
| Tongogara | 50 | 382.40 | 40,101.92 |
| Vakundwa | 50 | 673.50 | 66,572.55 |
| | 1,450 | 31,957.60 | 2,428,145.11 |

Note: Production is in metric tonnes and value is in Zimbabwe dollars.

Source: Phimister et al. 1987. Small Miners Co-operatives in Zimbabwe, with Particular Reference to the Ngesi Area. Paper presented at the Institute of Mining and Metallurgy Conference. Harare: September 1987.

departments are not subject to import taxes, the benefits ultimately accrue to the co-operatives.

3.2.2 Mining Legislation

Some of the problems identified earlier, such as safety and improper utilization of deposits, are sometimes due to lack of comprehension of relevant legislation. For the small entrepreneur not familiar with bureaucratic and administrative procedure, it is especially important that regulations in mining codes are clear, simple to understand, concise, and in definitive terms (Noetstaller, 1987).

The compilation of mine safety legislation effective for the whole industry is difficult because of different conditions in each mine. The difficulty is compounded in the case of small-scale mining because the operator, often a person with few skills and little or no supervision, pays little attention to rules whose practicality and applicability are not apparent. Therefore, apart from drawing up the regulations, the inspectorate must provide technical assistance and guidance on the best ways of complying with the regulations and providing feedback on defects and technical changes that may not be covered in the regulations.

Zimbabwe's Mining (Management and Safety) Regulations (1981) and the Explosives Regulations (1970) are currently under review. A draft is currently circulating at the Chamber of Mines, the Associated Workers Union, and the Attorney General's Office (Mining Annual Review, 1986). The author is aware, from his association with the Office of the Chief Government Mining Engineer, that the draft addresses safety aspects of small mines that were largely neglected in the 1981 version.

3.2.3 Intermediate Institutions

In many countries, government usually establishes other institutions, such as mining banks, state mining corporations, or research institutes for the purpose of providing specific services to promote a mining sector. In Zimbabwe, the Zimbabwe Mining Development Corporation is charged with the task of promoting co-operatives and ensuring their successful operation. ZMDC performs such tasks as ensuring the availability of consumables such as explosives, oils, and timber; providing technical guidance; and assisting with marketing arrangements. For such agencies to be effective, their physical presence in the districts as well as their technical competence is important. Phimister, et al. (1986) commented on the Ngesi

operation as follows:

Two major problems have so far been evident during the project life, namely supervision and procurement procedures.

There was no "site agent" to take charge of the day supervision of the project. The ZMDC Mining Advisor for the area, who was purported to fulfill this role, was not effective primarily because his other duties took him away from the mine for long periods. . . . With no petty cash available at the site . . . lack of small items like carbide and lubricating oils led to unnecessary machine shifts being lost.

This kind of service to the co-operatives can be effective only if ZMDC ensures greater contact between the co-operatives and the site agents, especially during the learning process. More advisors must be employed and of a calibre to appreciate the problems of co-operative mining.

3.2.4 Comment

The preceding three subsections have attempted to illustrate the importance of the policy and institutional framework within which the co-operatives in Zimbabwe operate. Experience from other countries shows that the nature of the policy initiatives that governments adopt determine the development of the small-scale mining sector. In this connection, Noetstaller (1987) has the following comment:

To improve legal gold trading, the Rwanda

Government in 1984 allowed private buyers and competitive bidding to enter the market. Nicaragua raised the price of gold by applying a higher exchange rate to reduce illicit trading of gold panned by individuals. A negative example is reported from Thailand where high royalties (five times the Malaysian rate), led to a deterioration of the already serious tin smuggling problem.

3.3 Stabilization Measures

In chapter 2 mention was made of the possibility of a sudden downturn in demand and the resultant loss of revenue on the part of the co-operatives. As already stated, since the inception of the co-operative movement, prices have continued to rise and there does not seem to be any cause for concern. Recent comments from the Mining Annual Review (1986) suggest that there exists an environment where producer-consumer exchanges might continue to achieve stabilization:

The production of ferro-chromite continues in a satisfactory manner and this aspect of the industry is expanding. The deep-level mining of seam chrome (i.e., along the Dyke) is non-viable and will remain so until some revolutionary method is utilized; possibly massive mechanization. Until then a growing reliance will be placed on small miners' co-operatives to produce good quality chrome at reasonable prices.

If, however, the situation does get to a point where the exchanges between the producers and consumers are not effective, stabilization is possible through the creation of a bufferstock via the government controlled Minerals Marketing Corporation (MMC). The buffer stock would be

used to buy chrome in times of low prices and sell when prices are high. The point at which purchase or disposal of the chrome is done determines the price range within which the market will operate. The rate of acquisition and disposal is also important in ensuring proper price stability. The MMC, since inception in 1982, has proved to be a valuable stabilizing tool for most of the mineral commodities in Zimbabwe. A report in the Mining Annual Review (1984) is testimony to this:

The advent of the Minerals Marketing Corporation, though widely criticized in its formative days, has proved to be a stabilizing force for producers. The expertise demonstrated by the Corporation is now generally appreciated and it is viewed as a step in the right direction by the mining industry.

The creation of a buffer stock should be viewed as a last resort since it entails costs associated with maintenance of the stock and depends to a large extent on the degree of judgment of long-term price trends in order to be effective.

3.4 Training

From discussions thus far, the importance of sound mining and business practices in small-scale operations is obvious. Though the same could be said of the large-scale operations, their situation is not as critical as that of

co-operatives whose members lack a sound educational background and who are relatively new to mining in particular and business in general. One way to remedy this is to provide on-the-job training conducted at suitable mines or the establishment of a institution such as the Recuay Mining Training center in Peru (Galorza and Ventura, 1978). In the case of on-the-job training, apprenticeship programs at suitable operating mines or at an established demonstration mine can be implemented. In Zimbabwe the Ministry of Manpower Planning and Development can implement such a program through the Apprenticeship Authority. Currently such apprenticeship programs are tailored to medium and large mines.

For a training institute, one has to assess the associated costs and weigh these against the benefits. The two-year diploma program offered at the Bulawayo School of Mines (Halloway, 1986) is suited for personnel at larger operations. This type of program might be more suitable for ZMDC "site agents" mentioned earlier.

3.5 Management and Organizational Structure

The nature of the organizational structure of co-operatives impinges on the proper management of their operations. The situation where the management committee

acting in a plural executive capacity manages the mining operations leads to inefficiency and has to be changed. In this connection the co-operatives have to view their operations from two different perspectives. In the first instance, they are members of the co-operative as equity holders, in which case the managing committee assumes the role of a board of directors. In the second, they are workers within an mining venture and the appointment of a mine manager is necessary. The Mining (Management and Safety) Regulations 1981 require this kind of structure and it is merely a matter of enforcing them.

3.6 Financial Assistance

Though co-operatives are generally labor intensive, there still exists a problem of acquiring the necessary capital to set up their small operations. As a rule most small-scale operations have little access to bank lending because of the collateral requirement. The almost exclusive source of funds, therefore, is personal savings, and in most developing countries, including Zimbabwe, there is little capacity to accumulate savings.

This problem has been overcome by the Plant Hire Fund referred to in chapter 2. There is, however, a need to continually evaluate the size and scope of the fund to

ascertain whether it meets the needs of the co-operatives.

3.7 Conclusion

The Zimbabwean government recognizes the need to create an institutional framework conducive to wholesome development of the co-operative movement. The following measures have been taken in order to achieve this objective:

(1) Substantial tax exemptions to ensure profitability.

(2) The mining (Management and Safety) regulations currently under review, to address safety aspects of the co-operative movement that were largely neglected in the previous version.

(3) The creation of an intermediate institution, the ZMDC, is recognition of the importance of assisting the co-operatives in areas such as marketing and administration. There is, however, a need for greater physical presence of the ZMDC.

(4) The Plant Hire Scheme in the Ministry of Mines is an invaluable tool in alleviating the problem of limited access to banks by the co-operatives.

Areas still requiring attention are the following:

(1) A training program, specifically tailored to the needs of co-operatives. This could be accomplished under

the Apprenticeship Authority.

(2) Enforcement of the mining (Management and Safety) regulations to achieve more effective management structures within the co-operatives.

Chapter 4 will consider one co-operative, the Ngesi Chrome Co-operative, that in many ways is representative of the average co-operative in Zimbabwe in that it exploits a deposit in the Great Dyke where most of the co-operatives in Zimbabwe are situated. It is labor intensive, operates under the ZMDC and therefore enjoys the same institutional benefits as all the other co-operatives. Chapter 4 will also illustrate the significance of measures discussed in this chapter, such as taxation and the Plant Hire Scheme.

Chapter 4

DISCOUNTED CASH FLOW ANALYSIS OF THE NGESI CO-OPERATIVE

4.1 Introduction

The Ngesi Chrome Co-operative was formed after some one hundred employees of the Ore Recovery Company had been laid off. After establishing the co-operative in 1983, the members began extracting ore from the remaining unfilled trenches using mattocks and pinch bars.

It was not until May, 1984 that the Department of Mining Engineering, realizing the limitations of trenching if the co-operative was to remain in one place, urged it to move to underground operations. The department, through the Plant Hire Scheme, provided all the capital equipment required, and ZMDC provided a loan of Z\$15,000 as working capital. No down payments were imposed and the loans were payable over a period of three years. At this point the Department of Mining Engineering assigned the mining engineer at Kadoma, a town about 60 miles from Ngesi, to monitor the Ngesi operation. At the same time, the ZMDC appointed a field supervisor, also based at the same town, to supervise the mine operations. The Ngesi mine is especially useful for this study. It has been monitored by the Department of Mining Engineering for three years, and the data are reliable. The costs, production, and revenue

figures used in this study are based on data furnished by the Kadoma office of the Mining Engineering Department for the years 1984 through 1986. The analysis covers a five-year period and the figures for the extra two years (1987 and 1988) are forecasts based on the first three years.

4.2 The Mine

The Ngesi claims are located on state land originally known as Turf Estates. Access is by the Battlefields recreational park dirt road, which comes off the main road connecting Harare and Masvingo (Phimister, et al. 1987). Figure 4.1 shows the position of the Ngesi claims relative to Kadoma (labeled Gatooma, its colonial name) and Harare (labeled Salisbury, also a colonial name), the capital.

Two chromite seams, part of the Hartley complex, are exposed within the area of the claims. The seams lie on the western side of the Great Dyke and occur within badly weathered serpentinite. They dip at about 10 to 15 degrees eastwards and strike approximately north-south, their width varying between 20cm and 40cm. The chrome is reputed to be of chemical grade. The mine was designed with three inclined shafts, Central North and South, dipping at approximately 10 degrees. Central shaft is serviced with

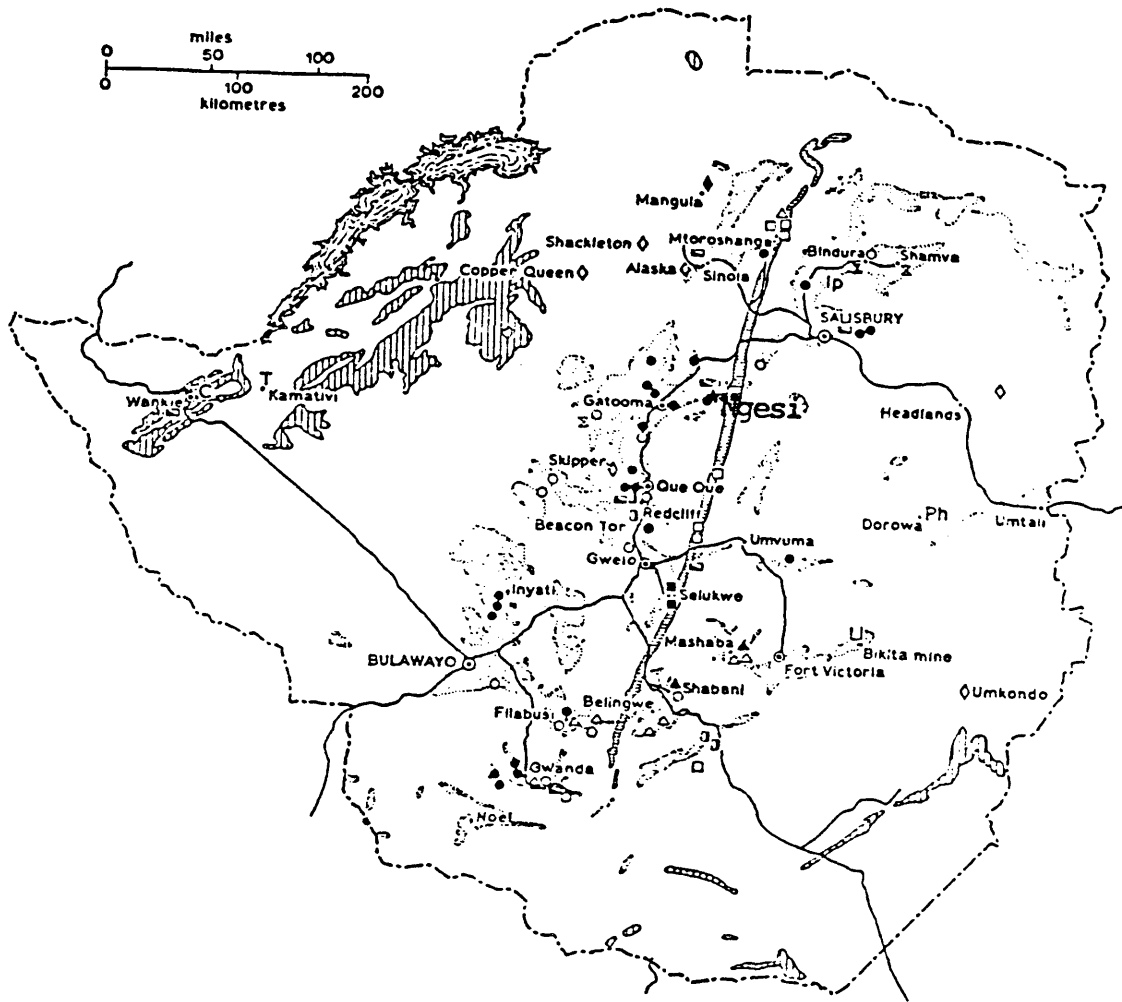


Figure 4.1

Location of the Ngesi Claims

Source: G. Kay. Rhodesia: A Human Geography. New York:
Africana Publishing Corporation, p.137.

tracks, compressed air, and water pipes while the other two, about thirty meters on either side of Central, are the stope faces from which stoping retreats towards Central. A crown pillar, about 6 meters was left below the surface and the first level was established at 17 meters below the pillar with subsequent levels at 12-meter intervals along the incline. Two of the shafts are shown in figure 4.2.

Because of the unavailability of electric power for charging caplamps, carbide lamps are used underground for illumination.

4.3 Costs

The analysis is done over a five-year period in constant 1980 dollars. For purposes of estimating the costs (transport, diesel, oils, timber, explosives, illumination and machinery maintenance) for the extra two years, a rate at which these costs are perceived to escalate must be established. This could be done by calculating an average rate based on historical data, but because this data is scanty this approach is not feasible. An alternative approach is to assume the rate of inflation represents the rate of escalation. This is probably a more realistic approximation, moreso if the rate of inflation is

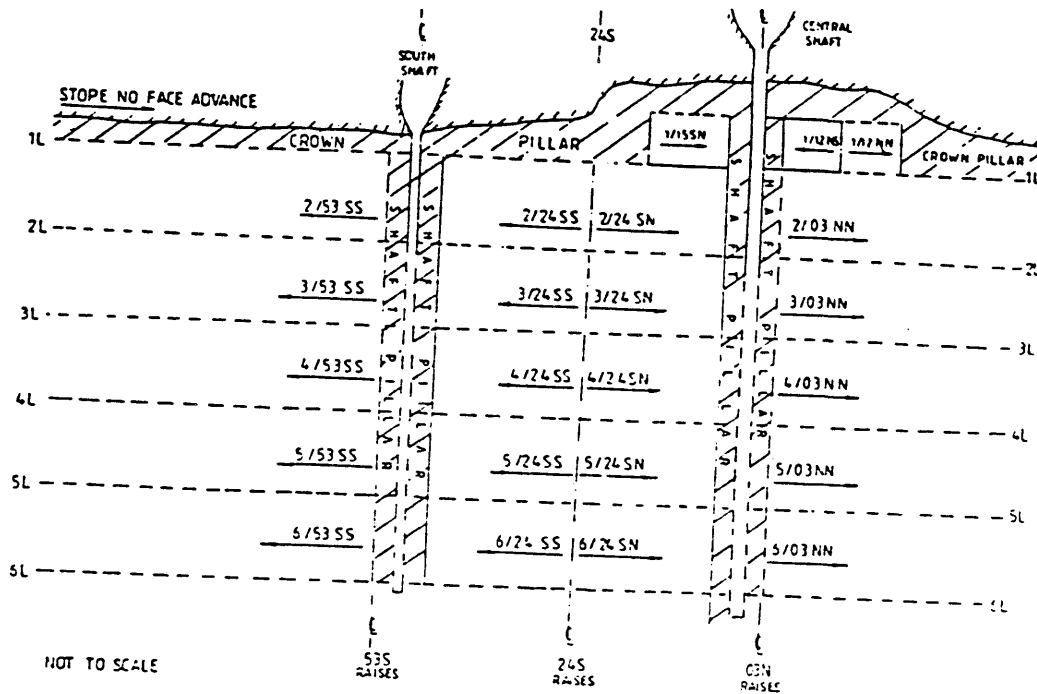


Figure 4.2

**Position of Proposed Stope Raises, Nomenclature
and Direction of Stope Faces**

Source: Phimister, et al. "Small miners Co-operatives with Particular Reference to the Ngesi Area." Paper presented at the Institute of Mining and Metallurgy Conference, Harare: September 1987.

is calculated using the GNP or GDP deflator, a parameter that reflects price levels in the whole economy.

4.3.1 Determination of Rate of Inflation

The inflation rate will be calculated using GDP price deflators. Table 4.1 shows GDP price deflators for the Zimbabwe economy (Green 1985). Calculations will be based on years 1980 through 1984 since this is period most relevant to the study. The figures for the rate of inflation for each of the years (table 4.2) result in an average rate of inflation of 10.96%. This will be the figure used to estimate the rate of escalation for the last two years of the analysis.

For the purpose of converting the escalated dollar values of the project cash flows to constant dollar values, the same inflation rate will be used for all the years except 1984 where the actual rate will be used.

4.3.2 Operating Expenses

The costs being considered under this sub-section will be escalated using the inflation rate for lack of a more appropriate escalation rate (e.g., producer price index or a mining costs index).

The cost of diesel oil, transport, timber, explosives,

Table 4.1

Gross Domestic Product Implicit Price Deflator (Zimbabwe)

(Base 1975 = 100)

| <u>YEAR</u> | <u>1973</u> | <u>1974</u> | <u>1975</u> | <u>1976</u> | <u>1977</u> | <u>1978</u> |
|--------------------|-------------|-------------|-------------|-------------|-------------|-------------|
| GDP Price Deflator | 0.81 | 0.94 | 1.00 | 1.10 | 1.19 | 1.26 |

| <u>YEAR</u> | <u>1979</u> | <u>1980</u> | <u>1981</u> | <u>1982</u> | <u>1983</u> | <u>1984</u> |
|--------------------|-------------|-------------|-------------|-------------|-------------|-------------|
| GDP Price Deflator | 1.46 | 1.65 | 1.79 | 1.99 | 2.31 | 2.45 |

Source: Green. 1985. "Parameters, Permutations and Political Economy: Zimbabwe 1973/83-1986/96." Paper presented at the Conference on Economic Policies and Planning under Crisis Conditions in Developing Countries. Harare: 2-5 September 1985.

Table 4.2

Inflation Rate (Zimbabwe)

(%)

| <u>YEAR</u> | <u>1980</u> | <u>1981</u> | <u>1982</u> | <u>1983</u> | <u>1984</u> |
|----------------|-------------|-------------|-------------|-------------|-------------|
| Inflation Rate | 13.01 | 8.48 | 11.17 | 16.08 | 6.06 |

Source: Calculations Based on Table 4.1.

illumination, and machinery for years 1984 through 1986 (table 4.3) are the actual costs incurred according to the Department of Mining Engineering of the Ministry of Mines. Observation of the costs shows that the costs in 1984 were much smaller than in the other two years, except for the costs of explosives, timber, and illumination. This is because during the early part of 1984 most of the work done was development work that necessitated greater use of these items despite reduced output. Machine maintenance costs are zero during the whole three-year period because these were borne by the Department of Mining Engineering as part of the Plant Hire agreement. These show up in 1987 and 1988 after the agreement expires. A rule of thumb approach is used to estimate the costs for these years (10% of the value of the plant at year 0 escalated at the inflation rate).

4.3.3 Wages

The co-operative made a decision early on that the ten workers selected to work at the mine would be paid Z\$150 per month for the first year, Z\$200 per month for the second year and Z\$300/month for the third year. The annual bill, however, reflects a higher amount than the above

Table 4.3

Operating Costs for 5-Year Period

(All costs are in escalated Zimbabwe dollars)

| <u>YEAR</u> | <u>1984</u> | <u>1985</u> | <u>1986</u> | <u>1987</u> | <u>1988</u> |
|-----------------|-------------|-------------|-------------|-------------|-------------|
| Diesel and Oils | 6,106 | 11,234 | 12,357 | 13,711 | 15,214 |
| Transport | 25,350 | 56,200 | 61,820 | 68,595 | 76,114 |
| Timber | 2,400 | 2,760 | 3,312 | 3,675 | 4,078 |
| Explosives | 5,347 | 6,296 | 6,926 | 7,685 | 8,527 |
| Illumination | 3,184 | 3,503 | 3,852 | 4,274 | 4,742 |
| Maintenance | 0 | 0 | 0 | 4,176 | 4,634 |
| Total | 42,377 | 68,759 | 88,267 | 102,117 | 113,309 |

Source: Phimister et al., 1987. "Small-Scale Miners Co-operatives in Zimbabwe with Particular Reference to the Ngesi Area." Paper presented at the Institute of Mining and Metallurgy Conference. Harare: September 1987.

figures because of payments made to casual labor employed to load chrome at the Battlefields rail siding. The costs for 1987 and 1988 are calculated using an escalation rate based on the trend of average mining sector wages since 1980. Appendix D lists the employees and earnings by industrial sectors (Zimbabwe Quarterly Digest of Statistics, 1987). An analysis of the mining and quarrying sector shows an increase in wages at an average of 14.22% since 1980. It is reasonable to use the rates since the attainment of independence because of their proximity to the period under consideration. The graph in figure 4.3 shows the trend of wages since 1975. Clearly, the rate up to 1980 is lower than that after.

Below is a list of the wages paid from 1984 through 1988:

| | |
|------|-----------|
| 1984 | Z\$22,000 |
| 1985 | 36,000 |
| 1986 | 54,000 |
| 1987 | 61,679 |
| 1988 | 70,450 |

4.3.4 Plant Hire Charges

All the plant at the mine was purchased through the Mining Industry Loan Fund's Plant Hire Fund, and the total

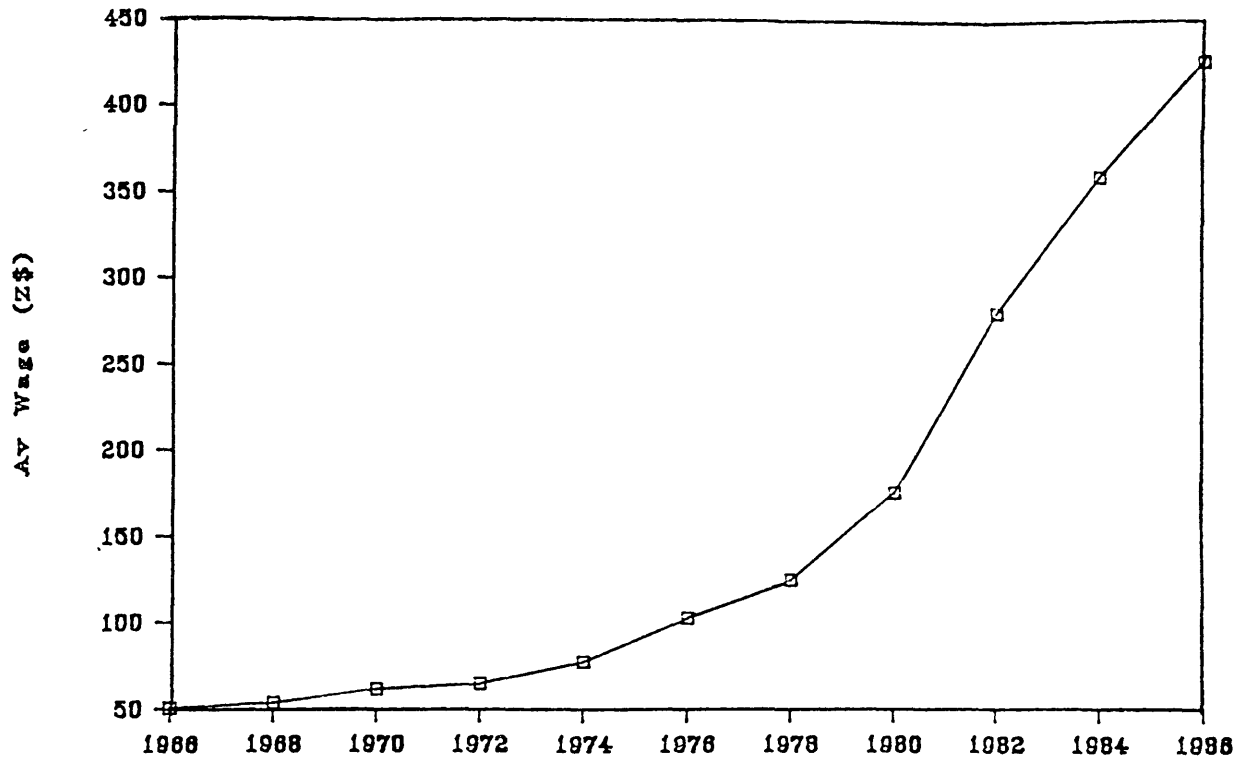


Figure 4.3
Wage Trends

cost was Z\$30,567 (see appendix E).

The interest rate charged has varied between 4% and 9% since its inception some twenty years ago and has always been significantly lower than that charged by commercial banks. The commercial bank lending rate at the start of the Ngesi was 14.75%, (Quarterly Digest of Statistics 1987) and that of the Mining Industry Loan Fund, 9%. The bank lending interest rate will be used as the minimum acceptable rate of return in this analysis because it represents the minimum return required to bring back borrowed capital.

The Plant Hire costs do not extend into 1987 and 1988 because the plant was paid off in 1986. Below is a list of the costs associated with Plant Hire:

| | |
|------|-----------|
| 1984 | Z\$ 9,860 |
| 1985 | 14,688 |
| 1986 | 14,688 |

4.3.5 ZMDC Charges

For the task of supervising the operations at Ngesi and providing a field supervisor, the Zimbabwe Mining Development Corporation charged the co-operative Z\$3 per ton in year 1, to be increased by 10% every year

thereafter. Assuming this arrangement continues over the entire period under consideration the costs associated with these charges are as follows:

| | |
|------|-----------|
| 1984 | Z\$ 3,867 |
| 1985 | 7,920 |
| 1986 | 8,712 |
| 1987 | 9,583 |
| 1988 | 10,541 |

4.4 Revenues

Sales agreements between the smelting companies and the co-operative spelled out, among other things, the price by the percentage of chromium in the ore. It was agreed that the price was open to negotiation. The average percentage of chromium in the ore over the initial three year period was 47%.

The tonnages produced in the first three years are as follows: 1,289 at Z\$63.00 per ton in 1984, 2,345 at Z\$69.59 per ton in 1985, and 2,467 at Z\$72.00 per ton in 1986. The forecast for prices in the last two years will be based on the price trend for chrome ore in Zimbabwe. This trend is illustrated in figure 4.4. The average rate of increase of price since 1980 is 14.43%. The graph in

figure 4.4 is generated from figures of production (tonnages), and value of chrome recorded for the chrome sector in Zimbabwe since 1970 (Quarterly Digest of Statistics 1987). For the purpose of this exercise, 14.43% will be used as the rate of increase of price for years 1987 and 1988.

The tonnages achieved during the last two years will be assumed to remain at the 1986 level, though indications are that production increased (ZMDC report on co-operatives implies that most of the co-operatives recorded increased tonnages but does not give figures). The sensitivity analysis in the following chapter will analyze, among other things, the effect of increased production and lower prices, and will allow comparison with the above assumptions.

4.5 Discounted Cash Flow Analysis

The previous sections have discussed the costs and revenues associated with the Ngesi project and the assumptions made in order to arrive at the figures for the last two years. Table 4.4 shows a discounted cash flow analysis of the above scenario. Depreciation in the analysis is straight line over the entire life of the mine with an assumed salvage value of zero. In the absence of a

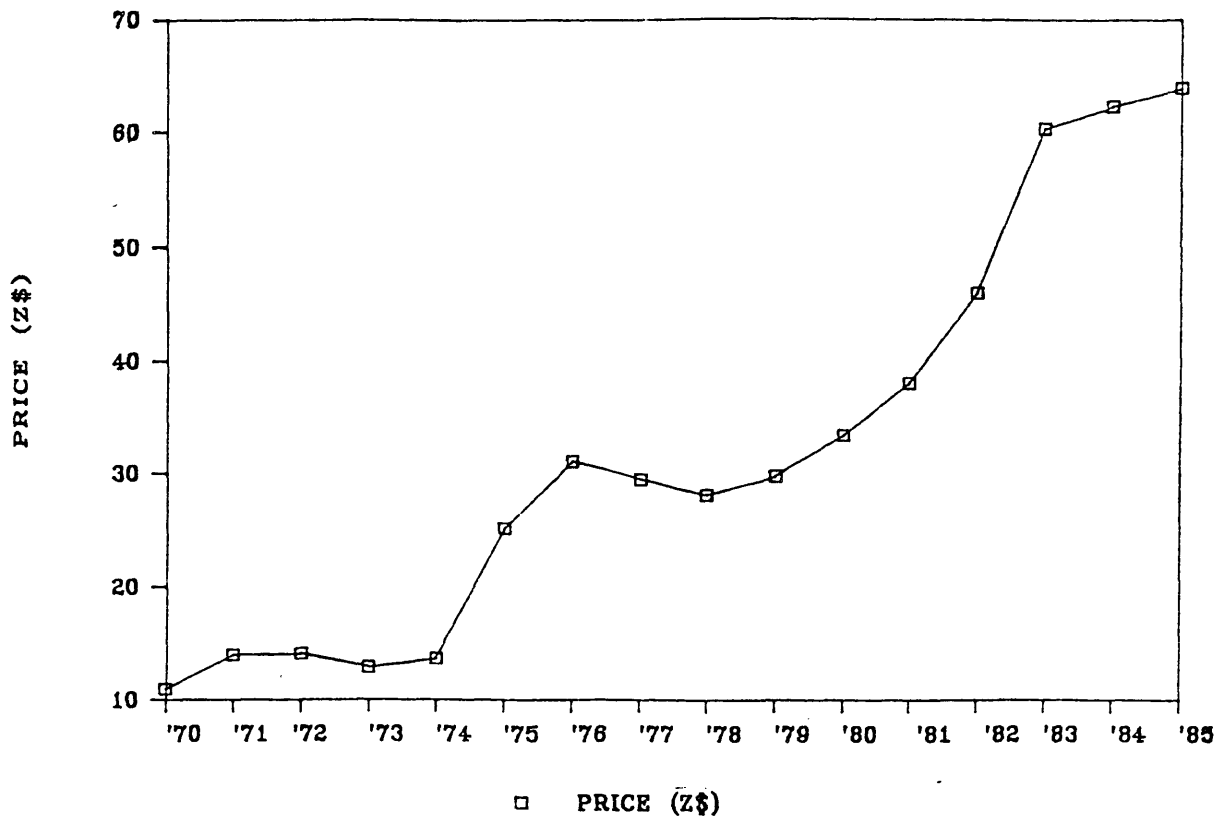


Figure 4.4
Chrome Price Trends

Table 4.4

Discounted Cash Flow Analysis-Base Case

| YEAR | 1,984.00 | 1,985.00 | 1,986.00 | 1,987.00 | 1,988.00 |
|------------------------|------------|------------|------------|------------|------------|
| REVENUES | 80,315.00 | 163,200.00 | 177,600.00 | 203,227.60 | 232,553.40 |
| WORK/CAP (15,000.00) | | | | | |
| COSTS | | | | | |
| Diesel and Oils | 6,106.00 | 11234 | 12,357.00 | 13,711.33 | 15,214.09 |
| Transport | 25,340.00 | 56,200.00 | 61,820.00 | 68,595.47 | 76,113.54 |
| Timber | 2,400.00 | 2,760.00 | 3,312.00 | 3,675.00 | 4,077.77 |
| Explosives | 5,347.00 | 6,296.00 | 6,926.00 | 7,685.09 | 8,527.38 |
| Illumination | 3,184.00 | 3,503.00 | 3,852.00 | 4,274.18 | 4,742.63 |
| M/c Maintenance | 0.00 | 0.00 | 0.00 | 4,175.92 | 4,633.60 |
| Operat Costs | 42,377.00 | 68,759.00 | 88,267.00 | 102,116.98 | 113,309.00 |
| Wages | 22,000.00 | 36,000.00 | 54,000.00 | 61,679.00 | 70,450.00 |
| Plant Hire | 9,864.00 | 14,688.00 | 14,688.00 | 0.00 | 0.00 |
| ZMDC Charges | 3,867.00 | 7,920.00 | 8,712.00 | 9,583.00 | 10,541.00 |
| TOTAL COSTS | 78,108.00 | 127,367.00 | 165,667.00 | 173,378.98 | 194,300.00 |
| DEPRECIATION | 6,113.50 | 6,113.50 | 6,113.50 | 6,113.50 | 6,113.50 |
| PRE-TAX INCOME | (3,906.50) | 29,719.50 | 5,819.50 | 23,735.12 | 32,139.90 |
| TAXABLE INCOME | 0.00 | 14,719.50 | 0.00 | 8,735.12 | 17,139.90 |
| TAXES | 0.00 | 7,617.34 | 0.00 | 4,520.42 | 8,869.90 |
| NET INCOME | (3,906.50) | 22,102.16 | 5,819.50 | 19,214.69 | 23,270.00 |
| Add Depreciat | 2,207.00 | 28,215.66 | 11,933.00 | 25,328.19 | 29,383.50 |
| C/FLO(ES) (15,000.00) | 2,207.00 | 28,215.66 | 11,933.00 | 25,328.19 | 29,383.50 |
| C/FLO(Con) (12,573.00) | 1,744.19 | 17,087.40 | 6,094.18 | 11,564.85 | 11,997.28 |
| DCFROR | | 0.33 | | | |
| NPV(i=0.034) | | 26,845.01 | | | |

guide as to the possible life of the equipment that was bought, it is fairly reasonable to assume that the plant lasts the life of the project.

The discounted cash flow rate of return and net present value are calculations based on the constant dollar cash flows. The constant dollar minimum rate of return is calculated below:

$$[(1 + 0.10474)/(1 + 0.1096)] - 1 = 0.0341$$

where 0.1474 is the escalated dollar minimum rate of return and 0.1096 is the inflation rate.

In table 4.4 the pre-tax net income is found by subtracting the total costs and depreciation from the revenues. Taxes are calculated as 51.75% of excess income above Z\$15,000. Net income is found by deducting taxes from the pre-tax income. The working capital of Z\$15,000 is reflected as a cost at year 0. The escalated cash flows from the above calculations are converted to constant dollar value by present worthing each value, at the respective inflation rate, to 1980 values. A minimum rate of return of 14.75% (bank lending interest rate) is used since this represents the minimum rate required to bring back borrowed capital. This is converted to a constant dollar rate in order to calculate the net present value in constant dollars.

4.6 Analysis

Table 4.4 shows that the Ngesi project will realize a net present value of Z\$26,845.00 at the end of a five-year period and a discounted cash flow rate of return of 32.89% making the project viable.

It is important to note that the policy and institutional framework within which the co-operative being considered operates plays a very important role in assuring viability. Provisions of the Plant Hire Fund, for instance, ensure that costs that would otherwise have been incurred at year 0 are spread over the project period. Table 4.5 illustrates how NPV is reduced if Z\$30,567.50 for the initial plant is all incurred in year 0. The policy of imposing tax only for income above Z\$15,000 helps towards viability as illustrated in the sensitivity analysis in the next chapter. This highlights the importance of some of the measures discussed in the previous chapter, such as taxation and financial assistance. Some, such as the role of intermediate institutions and proper legislation are difficult to quantify.

The next chapter, through a sensitivity analysis, will attempt to evaluate the impact on viability of variations in some of the parameters of the project. The parameters

Table 4.5

DCF Analysis: Initial Capital in Year 0

| YEAR | 1,984.00 | 1,985.00 | 1,986.00 | 1,987.00 | 1,988.00 |
|------------------------|-----------|------------|------------|------------|------------|
| REVENUES | 80,315.00 | 163,200.00 | 177,600.00 | 203,227.60 | 232,553.40 |
| WORK/CAP (45,567.50) | | | | | |
| COSTS | | | | | |
| Diesel and Oils | 6,106.00 | 11234 | 12,357.00 | 13,711.33 | 15,214.09 |
| Transport | 25,340.00 | 56,200.00 | 61,820.00 | 68,595.47 | 76,113.54 |
| Timber | 2,400.00 | 2,760.00 | 3,312.00 | 3,675.00 | 4,077.77 |
| Explosives | 5,347.00 | 6,296.00 | 6,926.00 | 7,685.09 | 8,527.38 |
| Illumination | 3,184.00 | 3,503.00 | 3,852.00 | 4,274.18 | 4,742.63 |
| M/c Maintenance | 0.00 | 0.00 | 0.00 | 4,175.92 | 4,633.60 |
| Operat Costs | 42,377.00 | 68,759.00 | 88,267.00 | 102,116.98 | 113,309.00 |
| Wages | 22,000.00 | 36,000.00 | 54,000.00 | 61,679.00 | 70,450.00 |
| Plant Hire | | | | 0.00 | 0.00 |
| ZMDC Charges | 3,867.00 | 7,920.00 | 8,712.00 | 9,583.00 | 10,541.00 |
| TOTAL COSTS | 68,244.00 | 112,679.00 | 150,979.00 | 173,378.98 | 194,300.00 |
| DEPRECIATION | 6,113.50 | 6,113.50 | 6,113.50 | 6,113.50 | 6,113.50 |
| PRE-TAX INCOME | 5,957.50 | 44,407.50 | 20,507.50 | 23,735.12 | 32,139.90 |
| TAXABLE INCOME | 0.00 | 29,407.50 | 0.00 | 8,735.12 | 17,139.90 |
| TAXES | 0.00 | 15,218.38 | 0.00 | 4,520.42 | 8,869.90 |
| NET INCOME | 5,957.50 | 29,189.12 | 20,507.50 | 19,214.69 | 23,270.00 |
| Add Depreciat | 12,071.00 | 35,302.62 | 26,621.00 | 25,328.19 | 29,383.50 |
| C/FLO(ES) (45,567.50) | 12,071.00 | 35,302.62 | 26,621.00 | 25,328.19 | 29,383.50 |
| C/FLO(Con) (38,194.68) | 9,539.71 | 21,379.27 | 13,595.34 | 11,564.85 | 11,997.28 |
| DCFROR | | 0.14 | | | |
| NPV(i=0.034) | | 19,249.40 | | | |

picked, such as production, initial capital outlay, prices, etc. are meant to illustrate the extent to which some of the attributes associated with co-operatives enhance or impede their viability.

Chapter 5

SENSITIVITY ANALYSIS

5.1 Introduction

The analysis here will concentrate on how sensitive the project under consideration is to certain specific parameters. It will look at the effect of taxes, prices, production, costs, and capital intensity on the viability of the co-operative. The chapter will also establish breakeven values for the parameters above.

5.2 Taxes

The scenario in the discounted cash flow analysis considered taxes as applicable to surplus income above Z\$15,000. We shall now remove the tax exemption and see to what extent this affects viability. Table 5.1 illustrates this scenario. It is evident that the DCFROR is reduced to only 25.07%, down from 32.89%. The net present value of the project reduces to Z\$17,751.29, down 34.26% from the original. In order to establish the rate of taxation for the co-operative to break even, the original situation of taxation for surplus above Z\$15,000 was maintained and different rates were applied. The graph in figure 5.1 illustrates that the project is capable of

Table 5.1

DCF Analysis: Tax Exemption Removed

| YEAR | 1,984.00 | 1,985.00 | 1,986.00 | 1,987.00 | 1,988.00 |
|------------------------|------------|------------|------------|------------|------------|
| REVENUES | 80,315.00 | 163,200.00 | 177,600.00 | 203,227.60 | 232,553.40 |
| WORK/CAP (15,000.00) | | | | | |
| COSTS | | | | | |
| Diesel and Oils | 6,106.00 | 11234 | 12,357.00 | 13,711.33 | 15,214.09 |
| Transport | 25,340.00 | 56,200.00 | 61,820.00 | 68,595.47 | 76,113.54 |
| Timber | 2,400.00 | 2,760.00 | 3,312.00 | 3,675.00 | 4,077.77 |
| Explosives | 5,347.00 | 6,296.00 | 6,926.00 | 7,685.09 | 8,527.38 |
| Illumination | 3,184.00 | 3,503.00 | 3,852.00 | 4,274.18 | 4,742.63 |
| M/c Maintenance | 0.00 | 0.00 | 0.00 | 4,175.92 | 4,633.60 |
| Operat Costs | 42,377.00 | 68,759.00 | 88,267.00 | 102,116.98 | 113,309.00 |
| Wages | 22,000.00 | 36,000.00 | 54,000.00 | 61,679.00 | 70,450.00 |
| Plant Hire | 9,864.00 | 14,688.00 | 14,688.00 | 0.00 | 0.00 |
| ZMDC Charges | 3,867.00 | 7,920.00 | 8,712.00 | 9,583.00 | 10,541.00 |
| TOTAL COSTS | 78,108.00 | 127,367.00 | 165,667.00 | 173,378.98 | 194,300.00 |
| DEPRECIATION | 6,113.50 | 6,113.50 | 6,113.50 | 6,113.50 | 6,113.50 |
| PRE-TAX INCOME | (3,906.50) | 29,719.50 | 5,819.50 | 23,735.12 | 32,139.90 |
| TAXABLE INCOME | 0.00 | 29,719.50 | 0.00 | 23,735.12 | 32,139.90 |
| TAXES | 0.00 | 15,379.84 | 0.00 | 12,282.92 | 16,632.40 |
| NET INCOME | (3,906.50) | 14,339.66 | 5,819.50 | 11,452.19 | 15,507.50 |
| Add Depreciat | 2,207.00 | 20,453.16 | 11,933.00 | 17,565.69 | 21,621.00 |
| C/FLO(ES) (15,000.00) | 2,207.00 | 20,453.16 | 11,933.00 | 17,565.69 | 21,621.00 |
| C/FLO(Con) (12,573.00) | 1,744.19 | 12,386.43 | 6,094.18 | 8,020.50 | 8,827.85 |
| DCFROR | | 0.25 | | | |
| NPV(i=0.034) | | 17,751.30 | | | |

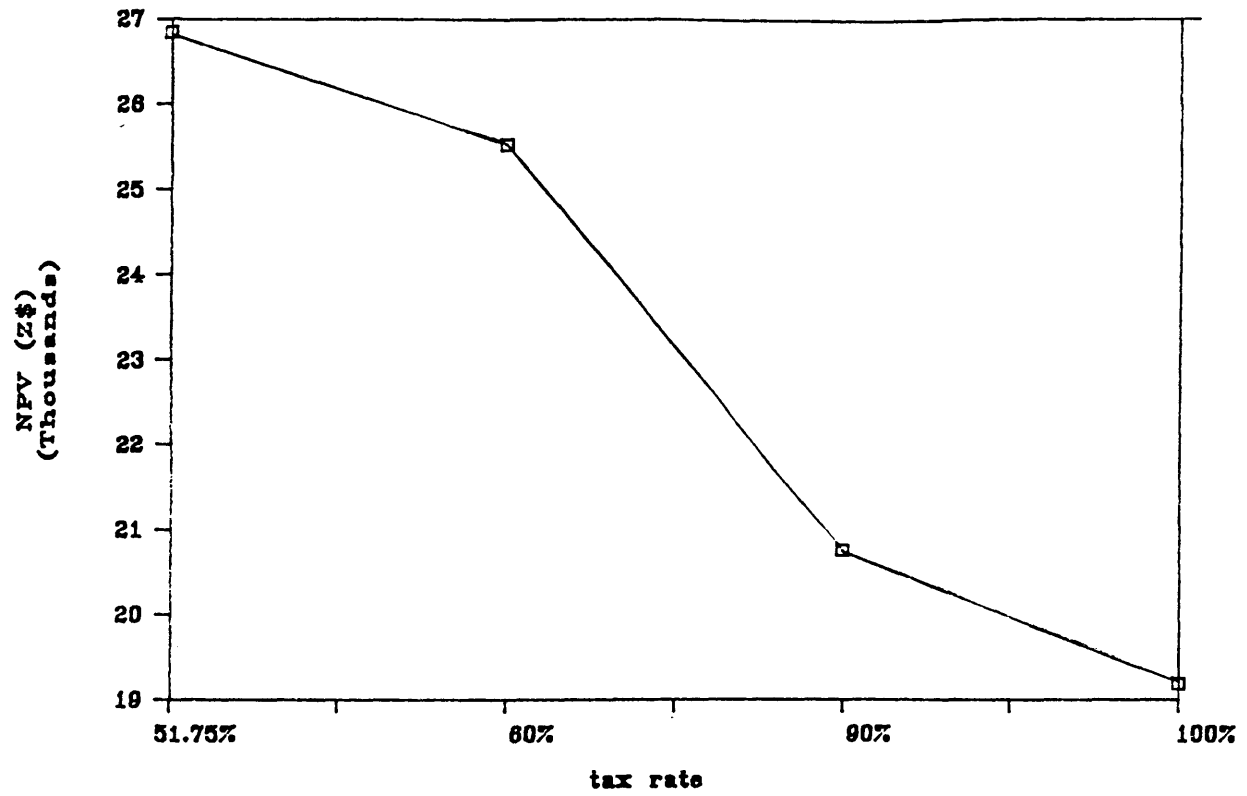


Figure 5.1

NPV against tax

profit even for taxation rates as high as 100%. The values used to arrive at the graph in figure 5.1 are shown in table 5.2. Evidently a net present value of Z\$19,192.55 is still realizable with a taxation of 100% for surplus above Z\$15,000.00.

Table 5.2

Tax Rate versus Net Present Value

| <u>Tax Rate</u> | <u>Net Present Value</u> |
|-----------------|--------------------------|
| 51.75% | 26,845.00 |
| 60.00 | 25,536.55 |
| 90.00 | 20,778.55 |
| 100.00 | 19,192.55 |

Source: Variation of taxation in the DCF Analysis.

From the results above the Z\$15,000 exemption from taxation for co-operatives is adequate as protection against future tax increases.

A situation worth investigating is how the co-operatives would do with less exemption. With an exemption of Z\$10,000 the project still realizes an NPV of Z\$23,813.76 and Z\$17,751.29 when exemption is completely

removed. The obvious conclusion is that the project is not very sensitive to taxation. In the future when the co-operative movement is firmly established the government might consider the removal of this exemption without the risk of putting a lot of co-operatives out of business.

5.3 Prices

In chapter 2 we observed how a monopsony tends to buy less at lower prices. In this section we shall investigate the effect of variation in prices. Table 5.3 illustrates a situation where prices drop by 20% during the final two years of the project. The net present value falls to -Z\$230.168, rendering the project nonviable. Obviously, unless there is a concurrent increase in production or reduction in costs, drastic downward changes in price have adverse effect on the profitability of the co-operatives. The graph in figure 5.2 based on the following figures shows that a drop in price of above 19.8% in the last two years will render the project non-profitable: for a price drop of 10% the project realized a NPV of Z\$7,021.83; Z\$3,333.22 for 15% drop; Z\$1,180.16 for 18% drop, and Z\$472.49 for 19% drop. Price fluctuations, therefore, have a significant impact on the viability of the co-operatives.

Table 5.3

DCF Analysis: Prices Drop by 20%

| Effect of Chrome Price on Profitability | | | | | |
|---|------------|------------|------------|-------------|--------------|
| YEAR | 1,984.00 | 1,985.00 | 1,986.00 | 1,987.00 | 1,988.00 |
| REVENUES | 80,315.00 | 163,200.00 | 177,600.00 | 142,080.00 | 113,664.00 |
| WORK/CAP (15,000.00) | | | | | |
| COSTS | | | | | |
| Diesel and Oils | 6,106.00 | 11234 | 12,357.00 | 13,711.33 | 15,214.09 |
| Transport | 25,340.00 | 56,200.00 | 61,820.00 | 68,595.47 | 76,113.54 |
| Timber | 2,400.00 | 2,760.00 | 3,312.00 | 3,675.00 | 4,077.77 |
| Explosives | 5,347.00 | 6,296.00 | 6,926.00 | 7,685.09 | 8,527.38 |
| Illumination | 3,184.00 | 3,503.00 | 3,852.00 | 4,274.18 | 4,742.63 |
| M/c Maintenance | 0.00 | 0.00 | 0.00 | 4,175.92 | 4,633.60 |
| Operat Costs | 42,377.00 | 68,759.00 | 88,267.00 | 102,116.98 | 113,309.00 |
| Wages | 22,000.00 | 36,000.00 | 54,000.00 | 61,679.00 | 70,450.00 |
| Plant Hire | 9,864.00 | 14,688.00 | 14,688.00 | 0.00 | 0.00 |
| ZMDC Charges | 3,867.00 | 7,920.00 | 8,712.00 | 9,583.00 | 10,541.00 |
| TOTAL COSTS | 78,108.00 | 127,367.00 | 165,667.00 | 173,378.98 | 194,300.00 |
| DEPRECIATION | 6,113.50 | 6,113.50 | 6,113.50 | 6,113.50 | 6,113.50 |
| PRE-TAX INCOME | (3,906.50) | 29,719.50 | 5,819.50 | (37,412.48) | (86,749.50) |
| TAXABLE INCOME | 0.00 | 14,719.50 | 0.00 | (52,412.48) | (101,749.50) |
| TAXES | 0.00 | 7,617.34 | 0.00 | (27,123.46) | (52,655.37) |
| NET INCOME | (3,906.50) | 22,102.16 | 5,819.50 | (10,289.02) | (34,094.14) |
| Add Depreciat | 2,207.00 | 28,215.66 | 11,933.00 | (4,175.52) | (27,980.64) |
| C/FLO(ES) (15,000.00) | 2,207.00 | 28,215.66 | 11,933.00 | (4,175.52) | (27,980.64) |
| C/FLO(Con) (12,573.00) | 1,744.19 | 17,087.40 | 6,094.18 | (1,906.54) | (11,424.49) |
| DCFROR | | 0.03 | | | |
| NPV(i=0.034) | | (230.17) | | | |

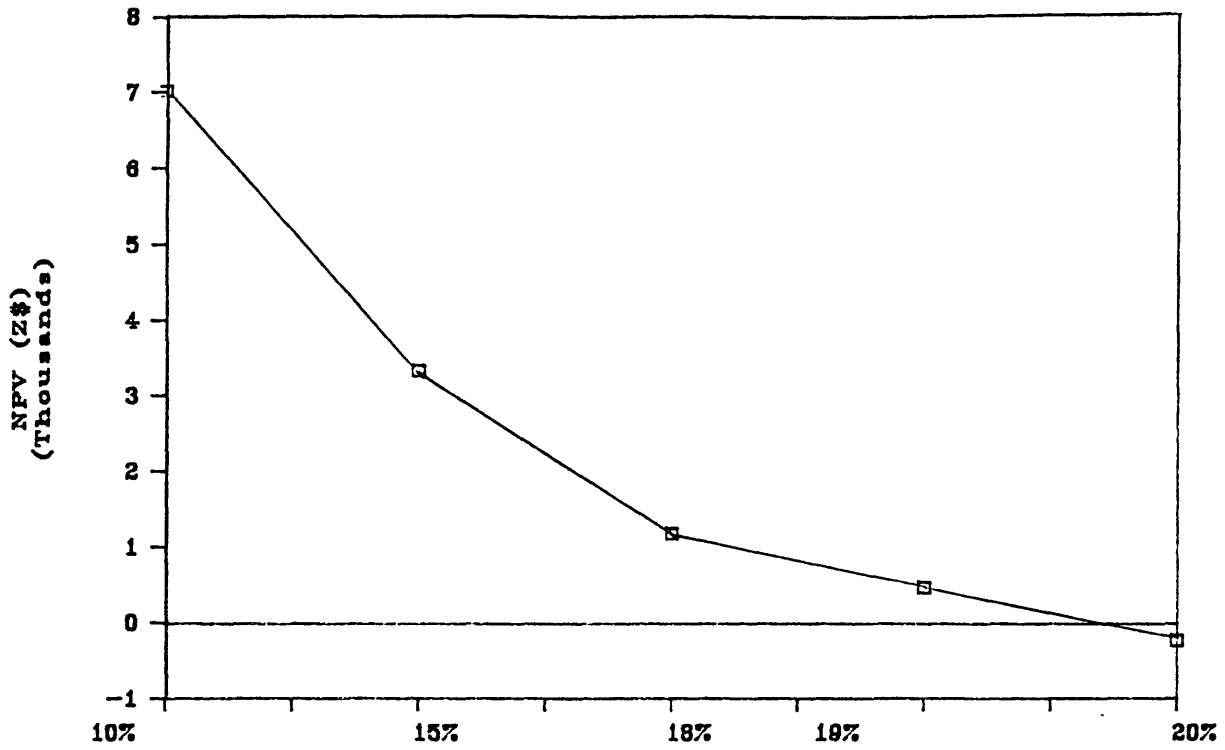


Figure 5.2
Percentage Drop in Prices versus NPV

5.4 Cost Escalation

In the discounted cash flow analysis, we assumed that the operating costs would escalate at an annual rate of 10.96% in the last two years. Let us now determine what levels of escalation the co-operatives can be capable of containing. The effect of cost escalation is less harmful than that of price reduction. The co-operative is non-profitable at 50% cost escalation in the last two years. This situation is shown in table 5.4. It breaks even at an escalation rate of 42.3%. The values of NPV at various levels of cost escalation are shown below. The data are based on table 5.4. A graphical representation of the same situation is shown in figure 5.3.

| <u>Escalation Rate (%)</u> | <u>Net Present Value</u> |
|----------------------------|--------------------------|
| 10.96 | 26,845.00 |
| 20.00 | 15,518.59 |
| 42.30 | 18.00 |
| 50.00 | -1,471.02 |

The co-operatives are therefore sensitive to cost escalation.

5.5 Capital Intensity

One of the attributes of co-operatives is low capital intensity. In this section, the value of capital equipment

Table 5.4

DCF Analysis for 50% Cost Escalation

| REVENUES | 80,315.00 | 163,200.00 | 177,600.00 | 203,227.60 | 232,553.40 |
|-----------------------------|------------------|-------------------|-------------------|-------------------|-------------------|
| WORK/CAP (15,000.00) | | | | | |
| COSTS | | | | | |
| Diesel and Oils | 6,106.00 | 11,234.00 | 12,357.00 | 13,711.33 | 15,214.09 |
| Transport | 25,340.00 | 56,200.00 | 61,820.00 | 68,595.47 | 76,113.54 |
| Timber | 2,400.00 | 2,760.00 | 3,312.00 | 3,675.00 | 4,077.77 |
| Explosives | 5,347.00 | 6,296.00 | 6,926.00 | 7,685.09 | 8,527.38 |
| Illumination | 3,184.00 | 3,503.00 | 3,852.00 | 4,274.18 | 4,742.63 |
| M/c Maintenance | 0.00 | 0.00 | 0.00 | 4,175.92 | 4,633.60 |
| Operat Costs | 42,377.00 | 79,993.00 | 88,267.00 | 102,116.98 | 113,309.00 |
| Wages | 22,000.00 | 36,000.00 | 54,000.00 | 61,679.00 | 70,450.00 |
| Plant Hire | 9,864.00 | 14,688.00 | 14,688.00 | 0.00 | 0.00 |
| ZMDC Charges | 3,867.00 | 7,920.00 | 8,712.00 | 9,583.00 | 10,541.00 |
| TOTAL COSTS | 78,108.00 | 138,601.00 | 165,667.00 | 260,068.47 | 291,450.01 |
| DEPRECIATION | 6,113.50 | 6,113.50 | 6,113.50 | 6,113.50 | 6,113.50 |
| PRE-TAX INCOME | (3,906.50) | 18,485.50 | 5,819.50 | (62,954.37) | (65,010.11) |
| TAXABLE INCOME | 0.00 | 3,485.50 | 0.00 | (77,954.37) | (80,010.11) |
| TAXES | 0.00 | 1,803.75 | 0.00 | (40,341.39) | (41,405.23) |
| NET INCOME | (3,906.50) | 16,681.75 | 5,819.50 | (22,612.99) | (23,604.88) |
| Add Depreciat | 2,207.00 | 22,795.25 | 11,933.00 | (16,499.49) | (17,491.38) |
| C/FLO(ES)(15,000.00) | 2,207.00 | 22,795.25 | 11,933.00 | (16,499.49) | (17,491.38) |
| C/FLO(Con(12,573.00)) | 1,744.19 | 13,804.81 | 6,094.18 | (7,533.67) | (7,141.73) |
| DCFROR | | 0.01 | | | |
| NPV(i=0.034) | | (4,342.70) | | | |

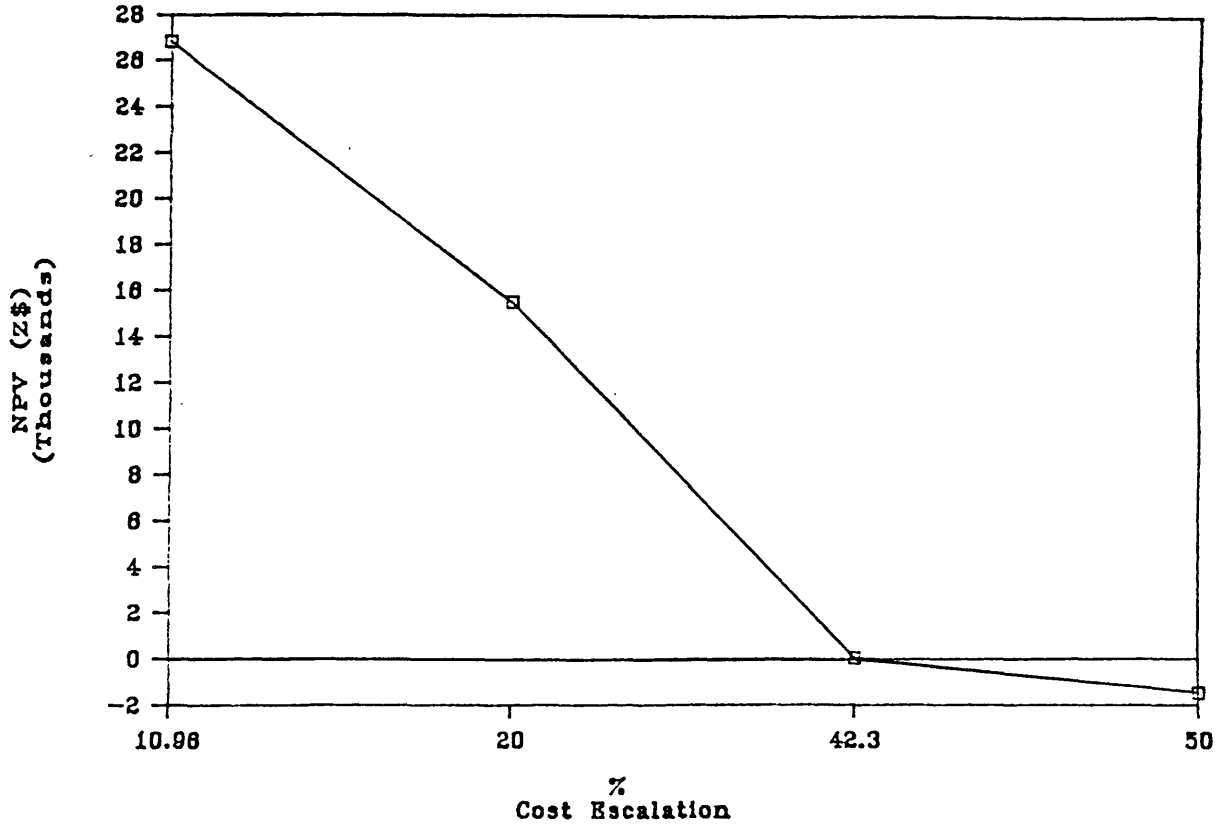


Figure 5.3

Cost Escalation vs. NPV

(Plant Hire Equipment) will be varied in order to establish what levels of capital intensity render the co-operatives non-viable. In carrying out this analysis there is no accommodation for the fact that increase in capital intensity implies reduction in operating costs. Table 5.5 illustrates a situation where the capital intensity is 2.65 that of the base case. The values below are used to draw the graph in figure 5.4. It is evident that at capital intensities 2.5 times the one considered in the discounted cash flow analysis co-operatives become non viable.

| <u>Capital Intensity</u> | <u>Net Present Value</u> |
|--------------------------|--------------------------|
| 2.00 | 9,966.47 |
| 2.50 | 1,069.64 |
| 2.65 | -1,507.89 |
| 3.00 | -7,522.15 |

5.6 Production

The effect of production (i.e., tonnages produced) on the viability of co-operatives would follow a very similar pattern to that of price since the two variables are interdependent in establishing the total revenue that is realized. Therefore, one can conclude that greater

Table 5.5

DCF Analysis for Capital Intensity of 2.65 times

Base Case

| YEAR | 1,984.00 | 1,985.00 | 1,986.00 | 1,987.00 | 1,988.00 |
|------------------------|-------------|------------|-------------|------------|------------|
| REVENUES | 80,315.00 | 163,200.00 | 177,600.00 | 203,227.60 | 232,553.40 |
| WORK/CAP (15,000.00) | | | | | |
| COSTS | | | | | |
| Diesel and Oils | 6,106.00 | 11234 | 12,357.00 | 13,711.33 | 15,214.09 |
| Transport | 25,340.00 | 56,200.00 | 61,820.00 | 68,595.47 | 76,113.54 |
| Timber | 2,400.00 | 2,760.00 | 3,312.00 | 3,675.00 | 4,077.77 |
| Explosives | 5,347.00 | 6,296.00 | 6,926.00 | 7,685.09 | 8,527.38 |
| Illumination | 3,184.00 | 3,503.00 | 3,852.00 | 4,274.18 | 4,742.63 |
| M/c Maintenance | 0.00 | 0.00 | 0.00 | 4,175.92 | 4,633.60 |
| Operat Costs | 42,377.00 | 68,759.00 | 88,267.00 | 102,116.98 | 113,309.00 |
| Wages | 22,000.00 | 36,000.00 | 54,000.00 | 61,679.00 | 70,450.00 |
| Plant Hire | 26,139.60 | 38,923.20 | 38,923.20 | 0.00 | 0.00 |
| ZMDC Charges | 3,867.00 | 7,920.00 | 8,712.00 | 9,583.00 | 10,541.00 |
| TOTAL COSTS | 94,383.60 | 151,602.20 | 189,902.20 | 173,378.98 | 194,300.00 |
| DEPRECIATION | 6,113.50 | 6,113.50 | 6,113.50 | 6,113.50 | 6,113.50 |
| PRE-TAX INCOME | (20,182.10) | 5,484.30 | (18,415.70) | 23,735.12 | 32,139.90 |
| TAXABLE INCOME | 0.00 | (9,515.70) | 0.00 | 8,735.12 | 17,139.90 |
| TAXES | 0.00 | (4,924.37) | 0.00 | 4,520.42 | 8,869.90 |
| NET INCOME | (20,182.10) | 10,408.67 | (18,415.70) | 19,214.69 | 23,270.00 |
| Add Depreciat | (14,068.60) | 16,522.17 | (12,302.20) | 25,328.19 | 29,383.50 |
| C/FLO(ES) (15,000.00) | (14,068.60) | 16,522.17 | (12,302.20) | 25,328.19 | 29,383.50 |
| C/FLO(Con) (12,573.00) | (11,118.41) | 10,005.83 | (6,282.73) | 11,564.85 | 11,997.28 |
| DCFROR | | 0.02 | | | |
| NPV(i=0.034) | | (1,507.90) | | | |

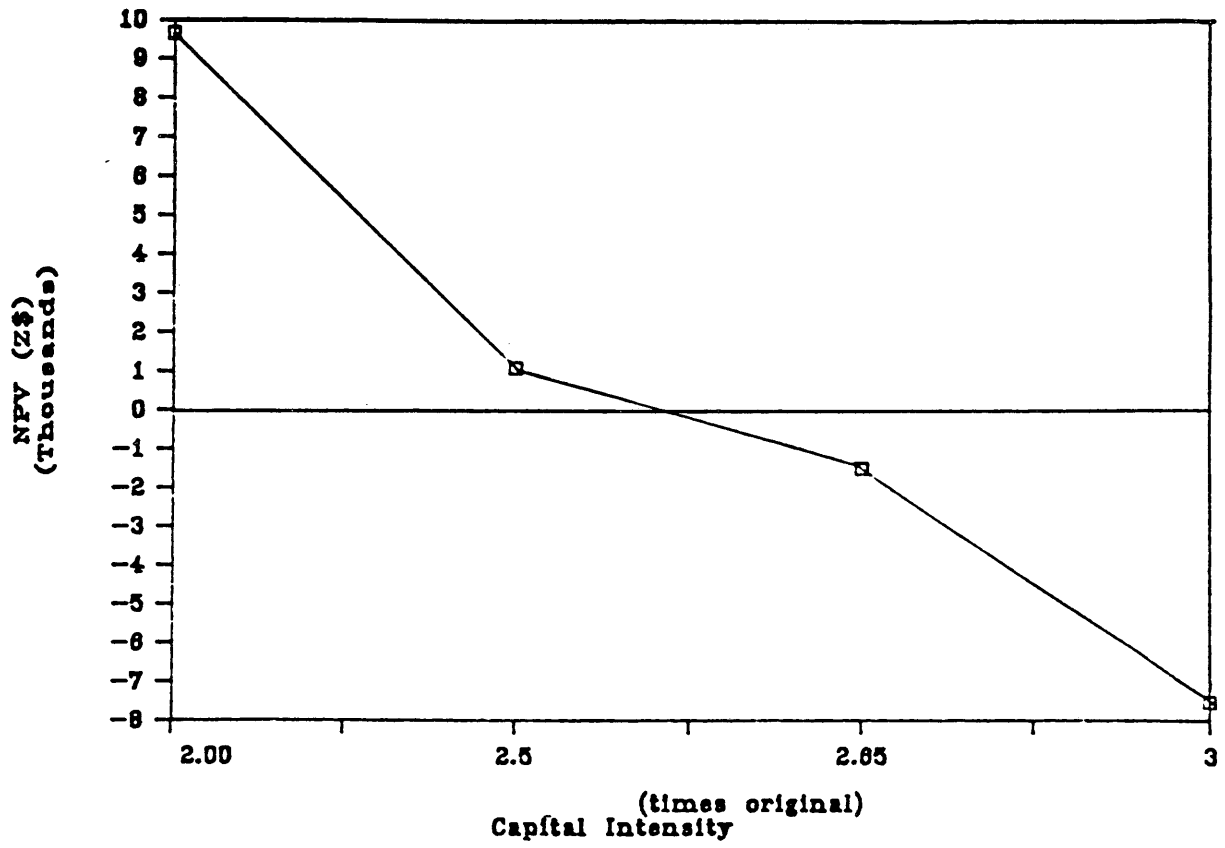


Figure 5.4

Capital Intensity versus Net Present Value

production increases NPV at approximately the same rate as price reduces it. The ZMDC report on co-operatives states that production among the co-operatives is increasing. We will assume that the price and cost levels remain the same and vary output upwards to see how NPV changes. Note, however, that the assumption about costs is not realistic since costs generally increase with increase in production. Table 5.6 shows a situation where there is a 20% increase in production. The NPV increases by 49.96% to a value of Z\$40,256.81. This is important to the co-operatives because in the event of adverse effects from the other parameters, increased production can be used as corrective action. Figure 5.5 shows the graph of NPV against increases in production. It is evident that for every percentage increase in production there is approximately twice that increase in NPV. The graph is based on the figures shown below:

| <u>Increase in Production</u> | <u>Net Present Value</u> |
|-------------------------------|--------------------------|
| 5% | 30,197.95 |
| 10 | 33,550.90 |
| 15 | 36,903.86 |
| 20 | 40,246.81 |

Table 5.6

| DCF Analysis for 20% Increase in Production | | | | | |
|---|----------------------|------------|------------|------------|------------|
| YEAR | 1,984.00 | 1,985.00 | 1,986.00 | 1,987.00 | 1,988.00 |
| REVENUES | 80,315.00 | 163,200.00 | 177,600.00 | 243,873.10 | 279,064.00 |
| WORK/CAP | (15,000.00) | | | | |
| COSTS | | | | | |
| Diesel and Oils | 6,106.00 | 11234 | 12,357.00 | 13,711.33 | 15,214.09 |
| Transport | 25,340.00 | 56,200.00 | 61,820.00 | 68,595.47 | 76,113.54 |
| Timber | 2,400.00 | 2,760.00 | 3,312.00 | 3,675.00 | 4,077.77 |
| Explosives | 5,347.00 | 6,296.00 | 6,926.00 | 7,685.09 | 8,527.38 |
| Illumination | 3,184.00 | 3,503.00 | 3,852.00 | 4,274.18 | 4,742.63 |
| M/c Maintenance | 0.00 | 0.00 | 0.00 | 4,175.92 | 4,633.60 |
| Operat Costs | 42,377.00 | 68,759.00 | 88,267.00 | 102,116.98 | 113,309.00 |
| Wages | 22,000.00 | 36,000.00 | 54,000.00 | 61,679.00 | 70,450.00 |
| Plant Hire | 9,864.00 | 14,688.00 | 14,688.00 | 0.00 | 0.00 |
| ZMDC Charges | 3,867.00 | 7,920.00 | 8,712.00 | 9,583.00 | 10,541.00 |
| TOTAL COSTS | 78,108.00 | 127,367.00 | 165,667.00 | 173,378.98 | 194,300.00 |
| DEPRECIATION | 6,113.50 | 6,113.50 | 6,113.50 | 6,113.50 | 6,113.50 |
| PRE-TAX INCOME | (3,906.50) | 29,719.50 | 5,819.50 | 64,380.62 | 78,650.50 |
| TAXABLE INCOME | 0.00 | 14,719.50 | 0.00 | 49,380.62 | 63,650.50 |
| TAXES | 0.00 | 7,617.34 | 0.00 | 25,554.47 | 32,939.13 |
| NET INCOME | (3,906.50) | 22,102.16 | 5,819.50 | 38,826.15 | 45,711.36 |
| Add Depreciat | 2,207.00 | 28,215.66 | 11,933.00 | 44,939.65 | 51,824.86 |
| C/FLO(ES) | (15,000.00) 2,207.00 | 28,215.66 | 11,933.00 | 44,939.65 | 51,824.86 |
| C/FLO(Con) | (12,573.00) 1,744.19 | 17,087.40 | 6,094.18 | 20,519.44 | 21,160.09 |
| DCFROR | | 0.37 | | | |
| NPV(i=0.034) | | 40,256.80 | | | |

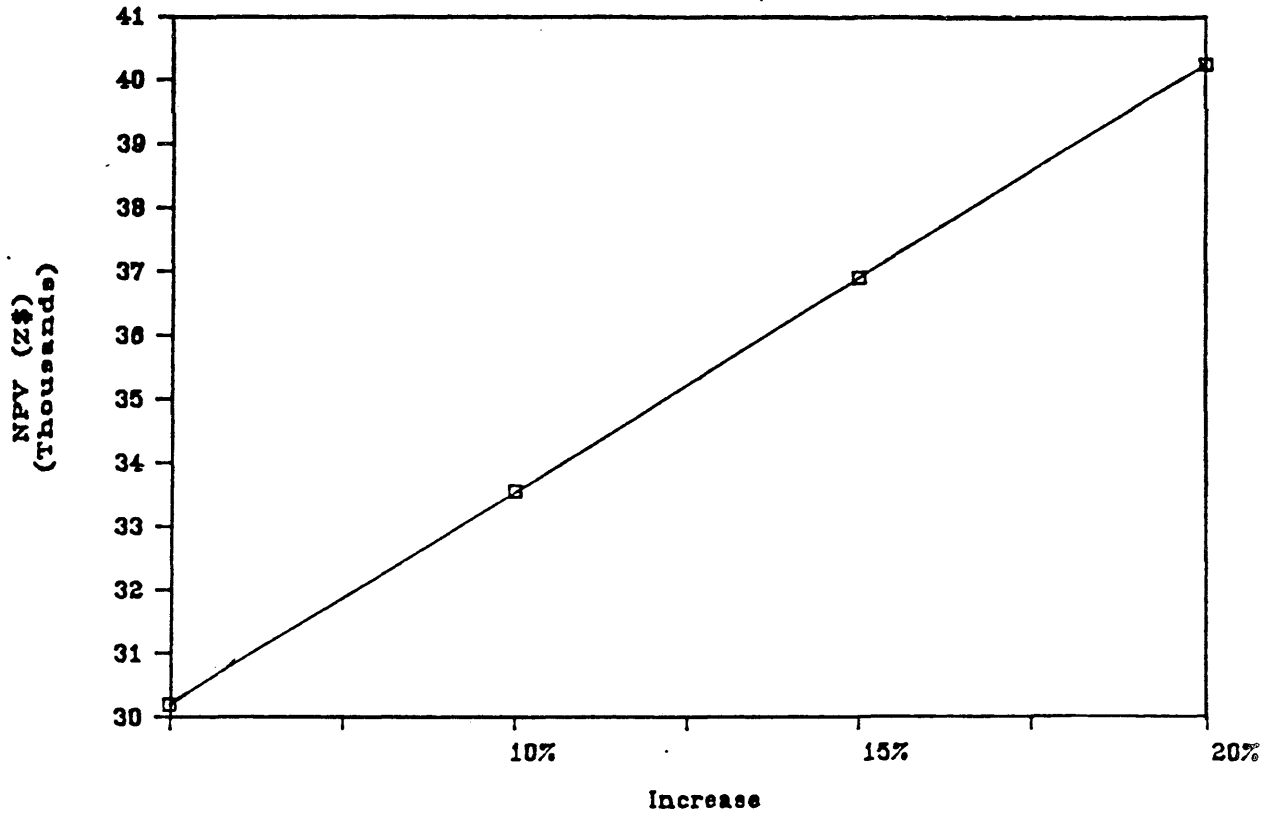


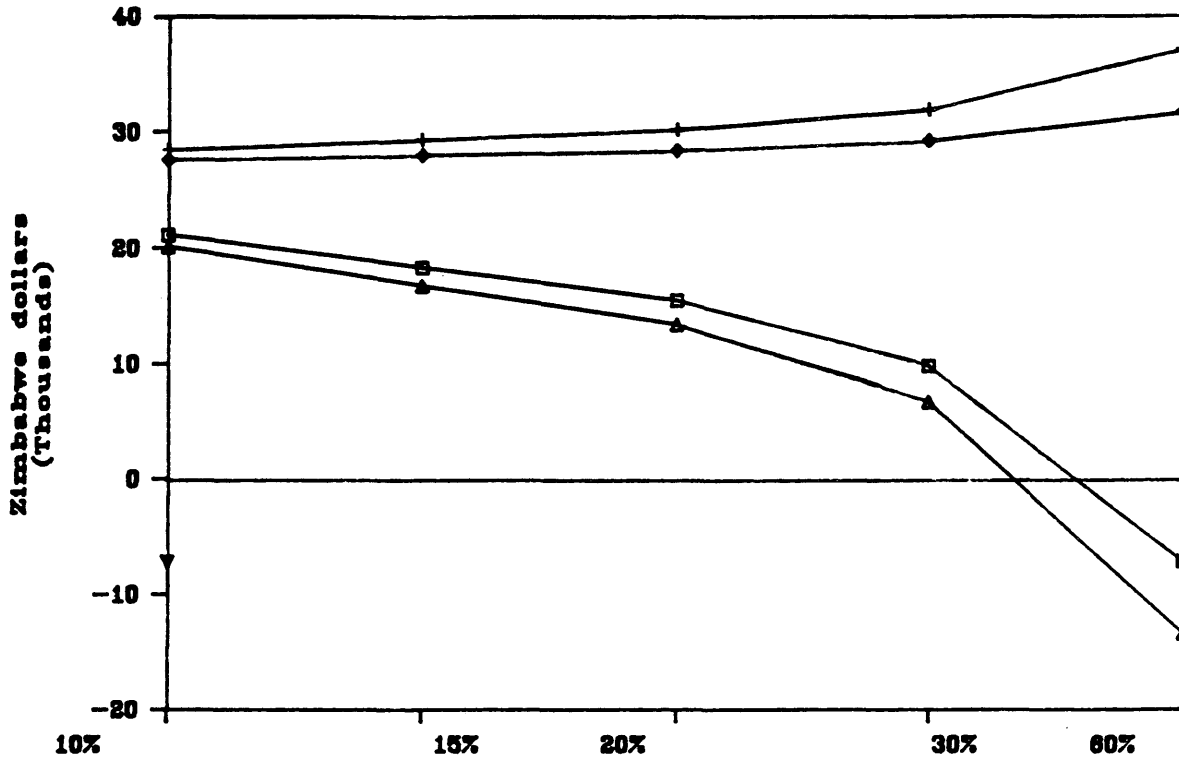
Figure 5.5
Production Sensitivity

5.7 Sensitivity Comparison

To compare the impact of the parameters discussed above on the viability of the co-operatives, it is necessary to examine the NPV realized for similar percentage decreases or increases in each of the parameters discussed above. We can then compare the extent to which the parameters affect the co-operatives. It is possible with this analysis to establish the important parameters to watch when profitability is going down, either for the purpose of improving performance or in order to control the downward trend. The values for such a comparison are below:

| <u>% Decrease</u> | <u>10%</u> | <u>15%</u> | <u>20%</u> | <u>30%</u> | <u>60%</u> |
|-------------------|------------|------------|------------|------------|------------|
| NPV (Price) | 20,139 | 16,786 | 13,433 | 6,727 | -13,390 |
| NPV (Tax) | 27,666 | 28,076 | 28,486 | 29,307 | 31,770 |
| NPV (Capital Int) | 28,563 | 29,423 | 30,282 | 32,000 | 37,155 |
| NPV (Cost) | 21,182 | 18,350 | 15,519 | 9,855 | - 7,134 |

The situation is represented graphically in figure 5.6. Notice that one of the curves slopes negatively while the rest have positive slopes. This indicates that a price decrease has a negative impact on viability while a decrease of the other parameters has positive implications. The important feature in the graphs is the magnitude of their tangents which shows the extent



Price Sensitivity Δ , Tax Sensitivity ◊ , Cost Sensitivity ◻ ,
Capital Intensity Sensitivity + .

Figure 5.6
Sensitivity Comparison

viability is increased or decreased by every percentage decrease or increase in the parameters. The implication of the graphs, therefore, is that despite the positive impact of decreasing tax, capital intensity, and escalation, the most significant impact is the negative effect of a reduction in prices. Cost also has a significant impact. It is evident, not surprisingly, that the crucial parameters in determining viability are price and costs.

5.8 Pessimistic and Optimistic Situations

The situation in the base case is what we might call the most likely case. Let us investigate the worst and the best situation. We shall depict each scenario by considering the worst and best situation in terms of price, production, and costs.

The worst situation is shown in table 5.7 where production drops by 29.45% (the biggest drop in overall chrome production since 1964, see figure 2.2) in the last two years, price does not change from the level in 1986 (prices have generally risen since 1970), and costs rise at a higher rate of 15%. This results in a negative NPV of Z\$48,623.80.

The optimistic situation is shown in table 5.8 where production rises by 35.97% in the last two years (biggest

Table 5.7

DCF Analysis: Pessimistic Scenario of Ngesi Co-operative

| YEAR | 1,984.00 | 1,985.00 | 1,986.00 | 1,987.00 | 1,988.00 |
|------------------------|------------|-------------|------------|--------------|--------------|
| REVENUES | 80,315.00 | 163,200.00 | 177,600.00 | 125,296.80 | 88,396.89 |
| WORK/CAP (15,000.00) | | | | | |
| COSTS | | | | | |
| Diesel and Oils | 6,106.00 | 11234 | 12,357.00 | 14,210.55 | 16,342.13 |
| Transport | 25,340.00 | 56,200.00 | 61,820.00 | 71,093.00 | 81,756.95 |
| Timber | 2,400.00 | 2,760.00 | 3,312.00 | 3,808.80 | 4,380.12 |
| Explosives | 5,347.00 | 6,296.00 | 6,926.00 | 7,964.90 | 9,159.63 |
| Illumination | 3,184.00 | 3,503.00 | 3,852.00 | 4,429.80 | 5,094.27 |
| M/c Maintenance | 0.00 | 0.00 | 0.00 | 4,175.92 | 4,633.60 |
| Operat Costs | 42,377.00 | 68,759.00 | 88,267.00 | 105,682.97 | 121,366.71 |
| Wages | 22,000.00 | 36,000.00 | 54,000.00 | 61,679.00 | 70,450.00 |
| Plant Hire | 9,864.00 | 14,688.00 | 14,688.00 | 0.00 | 0.00 |
| ZHDC Charges | 3,867.00 | 7,920.00 | 8,712.00 | 9,583.00 | 10,541.00 |
| TOTAL COSTS | 78,108.00 | 127,367.00 | 165,667.00 | 237288.7 | 265921.5 |
| DEPRECIATION | 6,113.50 | 6,113.50 | 6,113.50 | 6,113.50 | 6,113.50 |
| PRE-TAX INCOME | (3,906.50) | 29,719.50 | 5,819.50 | (243,402.00) | (183,638.00) |
| TAXABLE INCOME | 0.00 | 14,719.50 | 0.00 | (258,402.00) | (198,638.00) |
| TAXES | 0.00 | 7,617.34 | 0.00 | (133,723.04) | (102,795.17) |
| NET INCOME | (3,906.50) | 22,102.16 | 5,819.50 | (109,678.97) | (80,842.84) |
| Add Depreciat | 2,207.00 | 28,215.66 | 11,933.00 | (103,565.47) | (74,729.34) |
| C/FLO(ES) (15,000.00) | 2,207.00 | 28,215.66 | 11,933.00 | (103,565.47) | (74,729.34) |
| C/FLO(Con) (12,573.00) | 1,744.19 | 17,087.40 | 6,094.18 | (47,287.99) | (30,511.99) |
| DCFROR | | (0.14) | | | |
| NPV(i=0.034) | | (48,623.83) | | | |

Table 5.8

DCF Analysis: Optimistic Scenario of Ngesi Co-operative

Table 5.5
Optimistic Scenario of Ngesi Co-operative

| YEAR | 1,984.00 | 1,985.00 | 1,986.00 | 1,987.00 | 1,988.00 |
|------------------------|------------|------------|------------|------------|------------|
| REVENUES | 80,315.00 | 163,200.00 | 177,600.00 | 316,704.50 | 564,762.30 |
| WORK/CAP (15,000.00) | | | | | |
| COSTS | | | | | |
| Diesel and Oils | 6,106.00 | 11234 | 12,357.00 | 13,711.33 | 15,214.09 |
| Transport | 25,340.00 | 56,200.00 | 61,820.00 | 68,595.47 | 76,113.54 |
| Timber | 2,400.00 | 2,760.00 | 3,312.00 | 3,675.00 | 4,077.77 |
| Explosives | 5,347.00 | 6,296.00 | 6,926.00 | 7,685.09 | 8,527.38 |
| Illumination | 3,184.00 | 3,503.00 | 3,852.00 | 4,274.18 | 4,742.63 |
| M/c Maintenance | 0.00 | 0.00 | 0.00 | 4,175.92 | 4,633.60 |
| Operat Costs | 42,377.00 | 68,759.00 | 88,267.00 | 102,116.98 | 113,309.00 |
| Wages | 22,000.00 | 36,000.00 | 54,000.00 | 61,679.00 | 70,450.00 |
| Plant Hire | 9,864.00 | 14,688.00 | 14,688.00 | 0.00 | 0.00 |
| ZMDC Charges | 3,867.00 | 7,920.00 | 8,712.00 | 9,583.00 | 10,541.00 |
| TOTAL COSTS | 78,108.00 | 127,367.00 | 165,667.00 | 173,378.98 | 194,300.00 |
| DEPRECIATION | 6,113.50 | 6,113.50 | 6,113.50 | 6,113.50 | 6,113.50 |
| PRE-TAX INCOME | (3,906.50) | 29,719.50 | 5,819.50 | 137,212.02 | 364,348.80 |
| TAXABLE INCOME | 0.00 | 14,719.50 | 0.00 | 122,212.02 | 349,348.80 |
| TAXES | 0.00 | 7,617.34 | 0.00 | 63,244.72 | 180,788.00 |
| NET INCOME | (3,906.50) | 22,102.16 | 5,819.50 | 73,967.30 | 183,560.79 |
| Add Depreciat | 2,207.00 | 28,215.66 | 11,933.00 | 80,080.80 | 189,674.29 |
| C/FLO(ES) (15,000.00) | 2,207.00 | 28,215.66 | 11,933.00 | 80,080.80 | 189,674.29 |
| C/FLO(Con) (12,573.00) | 1,744.19 | 17,087.40 | 6,094.18 | 36,564.89 | 77,444.01 |
| DCFROR | | 0.46 | | | |
| NPV(i=0.034) | | 92,824.80 | | | |

rise in overall chrome production since 1964), price rises by 31.15% (biggest rise since 1970), and we shall assume the cost stays the same as it is unlikely that costs will fall. The net present value jumps to Z\$92,824.81 an increase of 245% on the base case.

5.9 Conclusion

The analysis done in this chapter shows that, though all the parameters considered have some impact on viability, the most important ones to watch are the market price of the commodity and the output from the co-operatives. These two determine the revenue realized by the co-operative. A decrease in one can be corrected by an increase in the other, but in a situation such as when a monopsonist tends to buy less at a lower price it might be difficult to correct.

The results of the optimistic scenario indicate that the project would gain Z\$65,979.81 in NPV. The NPV in the pessimistic situation goes down to -Z\$48,623.80, reflecting a decrease of Z\$75,468.80 on the base case.

Chapter 6

CONCLUSIONS

6.1 Introduction

The analyses in this study indicate that small-scale co-operative mines in Zimbabwe can operate successfully with government support. Although the mines present both negative and positive implications for national development, the positive implications outweigh the negative ones enough to warrant action to encourage their development. But, despite its positive attributes, the co-operative movement would face certain constraints and barriers if it were not for government assistance.

The government is taking measures to ensure the viable operation of the co-operatives. This study found that policy and institutional measures are crucial for the development of co-operatives. There is also an identified need for better organizational structure.

A discounted cash flow analysis of the Ngesi co-operative demonstrated economic viability of the co-operative, and a sensitivity analysis showed that price, costs, and production are crucial in determining profitability.

6.2 Attributes

Some of the positive attributes of the co-operatives are the following:

(a) A high labor intensity with potential to generate employment in the rural areas and thus arrest urban migration. Despite a scarcity of data, records on the performance of co-operatives in the last two years would suggest that co-operatives have a labor intensity of at least ten times that of large-scale mines. There is evidence that the labor intensity in the large-scale sector continues to diminish.

(b) Co-operatives have a low capital intensity and thus are not subject to the high cost of debt financing. Because of a lack of data, it is not possible to compare the capital intensity of the co-operatives with that of the large-scale mines. However, evidence from other sources on large-scale operations suggests that co-operatives have a very low intensity.

(c) There is potential for significant contribution of the co-operatives towards GDP as disposable income.

Some of the negative aspects are poor deposit utilization, unsatisfactory health and safety standards, and poor management and organizational structure.

6.3 Policy and Institutional Measures

The study has demonstrated that public policy can play an important role in ensuring that a sector, otherwise non-viable, becomes an important contributor to national development and social welfare. The chrome co-operatives in Zimbabwe, in the absence of government policy initiatives, are incapable of self-sustenance. They have inherent weaknesses such as a lack of potential to acquire capital, a lack of technical direction and sound managerial inputs, and they exploit marginal deposits. The fact that they have attributes capable of realizing substantial benefits for the rural population and the nation as a whole is justification for government policy initiatives in this sector.

The study identifies the role of public policy in this sector as follows:

- (1) To foster viability.
- (2) To strengthen the contribution of co-operatives to national development.
- (3) To ensure national self-determination in regard to mineral development.
- (4) To create rural employment.
- (5) To increase national skills.
- (6) To create entrepreneurship and social development.

- (7) To ensure proper deposit utilization and
- (8) To ensure a healthy and safe work environment.

The study shows that through proper identification of the problems which co-operatives face and relevant modification of policy it is possible to achieve the above objectives.

6.4 Viability

The viability of the co-operatives is largely dependent on the help they get from government. The Z\$15,000 tax exemption ensures that the co-operatives will always perform profitably despite heavy taxation. The Plant Hire Scheme is a vehicle through which the co-operatives can acquire most of the capital plant they require at reasonable terms. The ZMDC helps the co-operatives run their affairs profitably and does all the marketing for them. Without this help the co-operatives cannot be profitable.

The sensitivity analysis is also a demonstration of how effective some of the policy measures are. If the tax exemption were removed, the net present value would be 34% lower, whereas if the exemption is maintained, net present value is relatively insensitive to taxes. Though the project does show sensitivity to prices, the situation is

rather exaggerated. In the event of a drop in prices, reduced production would imply lower operating costs.

6.5 Comments

It is worth noting that this study has presented an overview of the various issues associated with co-operatives. It would be useful to carry out a more thorough investigation of the market, possibly incorporating empirical data on inputs, outputs, prices, etc., associated with both the consumers and producers of chrome in order to more accurately determine the behavior of the market.

A study of the multiplier effects associated with the fact that most of the revenue from co-operatives is retained in the country could reveal benefits to other sectors of the economy.

Another aspect that has not received enough attention here is the effect of management and organizational structure on viability. A study of this nature would call for more than mere familiarity with costs and revenues. It would require an in-depth appreciation of the day-to-day running of the operations. It is possible that such a study could reveal areas that can further improve the performance of the co-operatives.

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APPENDIX A
Summary of Operations

| INDUSTRY GROUP | YEAR | GROSS OUTPUT | | TOTAL PURCHASES AND CHANGES IN STOCKS | | NET OUTPUT | | PAYMENTS FOR SERVICES | WAGES AND SALARIES PAID | AVERAGE NUMBER EMPLOYED | TOTAL ALL SECTORS AT END OF YEAR | NET CAPITAL EXPENDITURE DURING YEAR |
|---|-------|---|---|---------------------------------------|--------------------------------------|--|--|-----------------------|-------------------------|-------------------------|----------------------------------|-------------------------------------|
| | | Including Sales of Goods not Produced on Prebases | Excluding Sales of Goods not Produced on Prebases | Including Goods Purchased for Resale | Excluding Goods Purchased for Resale | Including Goods not Produced on Prebases | Excluding Goods not Produced on Prebases | | | | | |
| | | \$'000 | \$'000 | \$'000 | \$'000 | \$'000 | \$'000 | \$'000 | \$'000 | No. | \$'000 | \$'000 |
| MINING : Chroite (2 X05) | 1977 | 16 157 | 16 111 | 5 322 | 5 290 | 10 837 | 10 823 | 1 421 | 5 402 | 6 098 | 4 378 | 2 011 |
| | 1978 | 8 892 | 8 869 | 3 560 | 3 537 | 5 332 | 5 332 | 1 250 | 4 279 | 4 702 | 4 740 | 724 |
| | 1979 | 9 941 | 9 911 | 4 624 | 4 624 | 5 288 | 5 288 | 1 038 | 5 083 | 4 835 | 6 832 | 1 083 |
| | 1980 | 16 569 | 16 501 | 6 397 | 6 350 | 10 151 | 10 139 | 1 138 | 6 470 | 5 204 | 8 421 | 2 103 |
| | 1981 | 15 412 | 15 323 | 8 457 | 8 406 | 6 956 | 6 918 | 1 116 | 9 160 | 4 953 | 10 037 | 3 970 |
| | 1982 | 18 123 | 18 123 | 10 285 | 10 285 | 7 840 | 7 840 | 1 660 | 10 881 | 4 299 | 11 497 | 2 836 |
| | 1983* | 20 601 | 20 601 | 3 555 | 3 555 | 17 046 | 17 046 | 319 | 5 866 | 1 812 | 11 497 | - |
| | 1984 | 21 893 | 21 893 | 2 130 | 2 130 | 19 763 | 19 763 | 324 | 5 917 | 1 842 | 4 212 | - |
| Copper and Nickel Including smelting (2 X04, 2 X05) | 1977 | 89 168 | 89 168 | 51 384 | 51 385 | 37 784 | 37 773 | 8 276 | 15 555 | 11 632 | 32 475 | 9 545 |
| | 1978 | 84 854 | 84 854 | 47 064 | 47 064 | 37 790 | 37 790 | 6 988 | 15 216 | 10 186 | 33 908 | 7 950 |
| | 1979 | 103 624 | 103 624 | 48 908 | 48 908 | 54 715 | 54 715 | 8 036 | 17 139 | 10 046 | 35 717 | 37 854 |
| | 1980 | 126 395 | 126 395 | 57 292 | 57 292 | 69 101 | 69 101 | 9 035 | 23 148 | 11 100 | 39 400 | 14 043 |
| | 1981 | 122 433 | 115 129 | 69 560 | 61 141 | 52 872 | 53 987 | 12 581 | 34 653 | 12 417 | 60 228 | 37 083 |
| | 1982 | 101 874 | 95 349 | 70 191 | 64 207 | 31 683 | 31 142 | 12 950 | 33 017 | 10 801 | 60 228 | 3 792 |
| | 1983 | 148 229 | 148 229 | 55 808 | 55 808 | 92 421 | 92 421 | 21 687 | 31 119 | 8 923 | 45 004 | 3 076 |
| | 1984 | 156 776 | 156 776 | 59 343 | 59 343 | 97 433 | 97 433 | 16 939 | 31 279 | 8 338 | 48 316 | 1 921 |
| Gold (2 X06) | 1977 | 45 463 | 45 463 | 15 678 | 15 678 | 29 785 | 29 785 | 3 885 | 13 551 | 15 231 | 4 944 | 3 756 |
| | 1978 | 58 783 | 58 783 | 18 154 | 18 154 | 40 629 | 40 629 | 4 058 | 15 090 | 15 820 | 4 804 | 5 455 |
| | 1979 | 88 695 | 88 695 | 25 704 | 25 704 | 62 989 | 62 989 | 3 718 | 18 492 | 17 303 | 6 486 | 7 966 |
| | 1980 | 144 497 | 144 497 | 31 282 | 31 282 | 113 212 | 113 210 | 5 382 | 28 677 | 21 533 | 8 304 | 26 992 |
| | 1981 | 119 681 | 119 681 | 30 471 | 30 471 | 89 217 | 89 217 | 6 721 | 39 986 | 20 874 | 9 932 | 47 541 |
| | 1982 | 129 577 | 129 577 | 43 873 | 43 873 | 85 700 | 85 700 | 9 074 | 52 703 | 20 592 | 11 251 | 23 682 |
| | 1983 | 223 561 | 223 503 | 77 144 | 77 142 | 146 417 | 146 361 | 9 750 | 61 403 | 19 112 | 16 663 | 25 233 |
| | 1984 | 211 244 | 211 241 | 70 617 | 70 615 | 140 627 | 140 627 | 10 972 | 66 125 | 22 452 | 20 221 | 24 612 |

Source: Zimbabwe Central Statistical Office. Quarterly.

Digest of Statistics, 1987. Harare: Zimbabwe

Government

APPENDIX B

ZMDC Report on Co-operatives

ZMDC ANNUAL REPORT ON CO-OPERATIVES
FOR PERIOD JULY 1986 TO JUNE 1987

The July 1986 to June 1987 period saw the completion of the task of Co-operativising chrome mining operations on the North Dyke; thus bringing an end to the contract system (Hadhobhadhobha) which Government condemned as a system that did not accord with general principles of equity as pronounced in Government policies after independence.

Basing on enquiries made during the period under review, more interest was shown by people in most mining areas of the country in the idea of Mining Co-operatives. The number of Mining Co-operatives registered with the Registrar of Co-operative Societies increased by 5 from 38 as at the first July 1986 to 43 at end of June, 1987. The number of operating chrome mining co-operatives increased by 10 from 18 to 28. There were 11 co-operatives still prospecting for a variety of minerals and four registered gold panning co-operatives.

The gold panning co-operatives took part in the Minerals Marketing Corporation of Zimbabwe's (MMCZ) experimental on-the-spot cash buying of gold. The twenty-eight chrome mining co-operatives sold 80 592 tonnes of chrome ore, that is, 113% up on last year's figure of 37 800 tonnes. The total sales revenue was 6 074 750. This sales figure exceeded the 1985/86 total sales revenue figure of \$2 100 000 by 3 974 750, up 189%. The total cash payout to members was 3 267 585 or an average of \$117 per month per member. The total cash payout was up 197% on previous year's figure of \$1 100 000, however, the average earnings per member was lower than last year's figures of \$126 per member due to the fact that the additional new members numbering 1 127 contributed to production for less than 12 months; a good number of them for less than 6 months.

The increase achieved in total production and total gross revenue resulted from an increase in the total number of operational co-operatives and the consequent increase in individual members of such Co-operatives from 1 191 to 2 318. The increase in price of chrome ore from an average of \$59,44 per tonne from January 1987 to an average of about \$76,50 per tonne contributed to the increase in gross sales revenue.

In order to solve the problem of the flooding of open pit mines during the rainy seasons, the Department of Mining Engineering in the Ministry of Mines, in Co-operation with the ZMDC successfully introduced underground mining at Ingezi Mining Co-operative. This underground mine will serve as a basis for future underground mining development plans in areas where underground mining is not yet being practised.

Source: ZMDC.

APPENDIX C
Co-operative By-Laws

MINING

BY-LAWS OF THE CO-OPERATIVE SOCIETY

NAME

1. (i) The name of the Society shall be Co-operative Society Limited and its registered address shall be
- (ii) The Registrar of Co-operative Societies shall be notified of all changes of addresses within fourteen days of every such changes, which shall not be regarded as an amendment to these by-laws;

OBJECTS

2. (i) The objects of the Society shall be :-
 - a to promote the economic interests of members in accordance with Co-operative principles and to provide collective facilities;
 - b to carry out mining operations on a Co-operative basis which shall include prospecting, processing and marketing;
 - c to contract for mining work;
 - d to provide training or to establish training facilities to enable members to acquire management and technical skills in order to increase output and improve the quality of the product;
 - e to provide to members services of a charitable and welfare nature not otherwise available to members of the Society or beyond their means to obtain and to donate to charities and welfare organisations;
 - f to promote and stimulate the spirit of Co-operation and Collective effort among the members.
- (ii) These objects may be achieved by:-
 - a raising funds by the issue of shares to members and persons admitted to membership in terms of these by-laws, by negotiating loans and overdraft facilities; by mortgaging movable and immovable property; tributing mining claims and by any other means;

meeting attended by not less than three-quarters of the total membership for:

- 1) Failure to pay any sum due to the co-operative after judgement has been given in favour of the Co-operative by any competent court;
- ii) failure to comply with any rules made in terms of by-laws 20 (iii) (p) below;
- iii) any action which may threaten the health, safety, or members financial wellbeing of the co-operative and other actions considered by the Committee and the General Meeting to be disloyal to or contrary to the interest of the co-operative and likely to defeat, frustrate or hinder the objects of the co-operative as defined in these by-laws;
- iv) A member expelled under these by-laws shall forfeit all rights to share in the surplus or other benefits of the Society and shall not be eligible for re-admission to membership for a period of one year from the date of such expulsion.
- v) No member who has been expelled from the society shall be eligible for re-election to membership for a period of one year from the effective date of such expulsion.

SUSPENSION

7. 1) The committee may, by vote of a simple majority recommend a member for expulsion under these by-laws and may then suspend such member from all rights and benefits in the Society until such time as his expulsion has been voted on by a general meeting under by-law 6 above.
- ii) If a general meeting held within eight weeks of the date of a member's suspension under this by-law (1) above confirms the Committee recommendation of expulsion, such expulsion shall be effective from the date of the suspension.
- iii) If a general meeting fails to approve by the two thirds majority of those voting the expulsion of the member, or if a general meeting for any reason does not vote on the proposal for expulsion within eight weeks from the date of suspension, the suspension shall be held to be immediately removed and the member treated as if no suspension had been imposed, and suspension shall not be reimposed in respect of the same offence unless it is a continuing offence.

NOMINEES

8. 1) Any member may, if he/she wishes, appoint in writing a nominee as provided for by section 13 of the Co-operative Societies Act (Chapter 193) to receive, if the committee agrees, his/her interest or share in the event of the member's retirement, insanity or death. Any member may alter in writing from time to time the name of such nominee.

- ii) In the event of a member becoming insane or dying without having appointed a nominee or if such nominee is dead, missing or cannot be otherwise traced within a period of 280 days from the date of the member's death, his/her interest and share in the Society shall be disposed of by direction of the committee only with the authority of the Registrar.
- iii) Nominees need not be members of the Society.
- iv) Ex officio members of the society shall consist, subject to the approval of the Registrar of not more than three representatives appointed by the Zimbabwe Mining Development Corporation and/or inclusive, by other relevant agency, which members shall not be numbered in the minimum total of members required to register a society or maintain a society in terms of Section 7 and 38 of the Co-operative Societies Act (Chapter 193). The provision of these by-laws relating to the supply of goods or services to members, the liability of members and to nominees, resignations, suspension and expulsion from membership shall not apply to such Ex Officio members.

DEBTS

9. Any debt owed by a member of the Society to the Society may be recovered from any sums due to him/her from the Society.

LIABILITY

10. The liability of a member for the debts of the Society shall be limited to the nominal value of his/her shares in the Society subject to the provisions of section 28 of the Co-operative Societies Act (Chapter 193) provided that no liability for the debts of the Society shall be incurred by the ex-officio members as defined these by-laws.

SHARES

11. 1) Every member shall hold at least one share in the Society;
- ii) Shares in the Society shall be one dollar each;
 - iii) The general meeting may, on the recommendation of the committee authorise the issue to members of new shares to raise additional capital;
 - iv) On termination of membership for any of the reasons set out in by-laws (4) (i) above, the Committee may either cancel the shares held by the member, refund the nominal value of such shares to him, or transfer the said shares to his heir or nominee.;
 - v) No member shall hold shares in the society the nominal value of which exceeds or one twentieth of the subscribed capital of the Society whichever is the greater.

FINANCIAL YEAR

12. Financial year to the Society shall end on the 30th June each year, at which date the financial accounts of the co-operative shall be closed and the stock-in-hand shall be valued at cost price or current purchase price whichever is the lesser.

SURPLUS

13. Out of the net annual surplus of the Co-operative resulting from excess of total income over total expenditure, not less than 25% shall be credited to the Reserve Fund. The balance of the surplus may be appropriated as follows:-
- i) to such special reserves as the Committees may recommend and the General Meeting approve;
 - ii) The distribution of the surplus to special reserves and members as provided in 13 above, shall be subject to the financial position of the society and the need to retain working capital.
 - iii) to such gratuities to staff and contributions to a WELFARE FUND which the Co-operative may set up to carry out its objects in by-laws 2 (i), (a) to (f) above;
 - iv) to such donations to charities and welfare organisations as the Committee may recommend and the General Meeting approve;
 - v) The Committee may recommend and the General Meeting approve the payment of such dividend on shares, not exceeding 10% per annum, from the remaining surplus.
 - vi) Any balance remaining thereafter, to such investment and development of communal facilities or any project which shall benefit the society as a whole.

RESERVES

14. No member shall have a claim to a share in the Reserve Fund except in terms of section 46 of the Co-operative Societies Act (Chapter 193).

BANKING

15. 1) Except where the society's banking is done by a Co-operative Union of which it is a member, the Society shall maintain a bank account or accounts with one or more recognised commercial banks.
- ii) Cheques and other negotiable instruments signed on behalf of the society shall require three signatures being the Chairman or Vice Chairman, Secretary or Vice Secretary and Treasurer.

GENERAL MEETINGS

16. xi) The supreme authority of the Society shall, subject to the provisions of these by-laws, be vested in the general meeting.

- h) to handle all contracts and legal matters on behalf of the Co-operative. All contracts shall bear on behalf of the Co-operative, three signatures, being the signature of the Chairman or Vice Chairman, the Secretary or Vice-Secretary and the Treasurer;
- i) to acquire on behalf of the Co-operative shares in other registered co-operative societies of limited liability and to appoint delegates to represent the Co-operative;
- j) to open and maintain in proper order one or more bank accounts on the Co-operative society's behalf;
- k) to negotiate loans from members or non-members subject to approval of the maximum amount of loan by the general meeting;
- l) to suspend members and recommend expulsion under these by-laws;
- m) to pay from funds of the Co-operative to members of the Committee or consultants reasonable expenses, on such scales as the General Meeting shall approve, incurred solely in the execution of their duties on behalf of the Co-operative;
- n) to decide pay, remuneration, bonuses and contributions in terms of sub-section (m) above and by-laws 11 above. In making these decisions the Committee shall take into consideration, for submission to the General Meeting for approval, the following principle;

EQUAL PAY FOR EQUAL WORK

- o) to appoint sub-committees for any purpose connected with the Co-operative's business, provided that the Chairman of any such sub-committee shall be a member of the Managing Committee;
- p) to make rules, which shall be approved by the General Meeting which shall be binding upon all members connected with member's duties, rights and obligations to the Co-operative and on such matters as wages, salaries, allowances in cash and kind housing facilities, hours of work and terms and conditions of membership, and to change and amend these rules from time to time;
- q) to make rules regarding any training offered to members, setting out the conditions applicable to such training and the rights, duties and obligations of members accepting the offer of training;
- r) to appoint, not more than three ex-officio members of the Society which members shall not be numbered in the minimum total of members required to register a society in terms of sections 7 and 38 of the Co-operative Societies Act (Chapter 193). The provisions of these by-laws relating to the supply of goods or service to members, the liability of members and to nominees, resignations, suspensions, suspension and expulsion from membership shall not apply to such ex-officio members who may resign from the Society at any time;
- s) In the conduct of the affairs of the Co-operative the committee shall be responsible severally and collectively to the Co-operative for any loss sustained by the Co-operative by acts contrary to the law or to these by-laws.

- ii) The Annual General Meeting shall be held as soon as possible after the date of the financial year end and in no case later than three months after such date.
- iii) A general meeting shall be held at other times when summoned by the Registrar of Co-operative Societies, the Chairman of the society, the committee of its own motion or through the Chairman, Officials of the Ministry of Mines, Zimbabwe Mining Development Corporation or at the written request of one fourth of the members of the Society.
- iv) At least fourteen days notice shall be given to all members of the intention to hold a general meeting but non-receipt of any such notice by any member shall not invalidate the proceedings of such general meeting. The notice shall state the date, time, place and the business to be transacted.
- v) The presence of at least twenty members, or of one third of the total membership of the Society, whichever is the lesser, shall constitute a quorum which shall be necessary for the transaction of any business at a general meeting.
- vi) If within one hour after the time appointed for the meeting a quorum is not present, the meeting, if convened upon the requisition of members, shall be dissolved, in any other case it shall stand adjourned to the same place on the same day two weeks hence and if at such adjourned meeting a quorum is not present within one hour after the time appointed for the meeting the members present, provided they number not less than six, shall constitute a quorum and shall deal with the business on the published agenda of the original meeting and any decisions made shall be binding on the Society.
- vii) Notice of any adjourned meeting shall be given to members not less than seven days in advance, but non-receipt of any such notice by any member shall not invalidate the proceedings of any adjourned general meeting.

VOTING

- 17. i) Except for amendments to these by-laws and expulsion under these by-laws, all matters before a general meeting shall be decided by a simple majority of those members present and voting, provided they constitute a quorum in terms of by-laws 16 (v) above.
 - ii) Amendments to these by-laws require the assent of three fourths of the members present in a general meeting attended by not less than one-half of the total number of members; except where the Registrar of Co-operative Societies has given his/her approval to a proposed amendment such amendment may be adopted by a clear majority of members present.
 - iii) Each member shall have only one vote, irrespective of the number of shares held by him/her, except that in the case of equal voting the Chairman of the meeting shall have a second or casting vote.
 - iv) Voting by proxy shall not be permitted.

BUSINESS AT GENERAL MEETING

18. 1) The following business shall be reserved for the General Meeting:-
- a) the election, removal and suspension of members of the Managing Committee.
 - b) Consideration of the annual statement of accounts and balance sheet and the audit report.
 - c) Disposal of any surplus of the Society in accordance with the Act, the Regulations made thereunder and these by-laws.
 - d) amendments to these by-laws
 - e) expulsion of members.
- ii) All business discussed and decided at a general meeting shall be recorded in a minute book and the record shall be signed by the Chairman of the general meeting which confirms the record.

MANAGING COMMITTEE

19. 1) The Committee shall in addition to ex-officio members consist of, members of the Society, over the age of eighteen years, being a Chairman, who shall be Chairman of the Co-operative and the General Meeting, a Vice Chairman, a Secretary and Vice Secretary, Treasurer and Committee members.
- ii) The members of the committee shall be elected at the Annual General Meeting at which two-thirds of the members of the committee shall retire and shall not be eligible for re-election except in terms of by-law 19 (iii) below.
 - iii) Casual vacancies on the committee shall be filled by co-option by the rest of the committee, to cover the un-expired portion of the committee's term of office
 - iv) A member of the committee shall cease to hold office if he:-
 - a) ceases to be a member of the Society
 - b) is declared insolvent;
 - c) is convicted in a court of law of any offence involving dishonesty or is imprisoned for three months or more.
 - d) is removed from office by a General Meeting;
 - e) is absent without the approval of the committee from three consecutive meetings of the Committee.
 - f) holds any office of profit under the Society or receives any form of emolument therefrom, unless the approval of the Registrar of Co-operative Societies has been obtained.
 - g) has judgement for debt entered against him in favour of the Society by any court of law.
 - h) resigns from the committee in writing.

- (v) Members of the committee ceasing to hold office for any of the reasons stated in By-laws 19 (iv) above shall not be eligible to serve on the committee for a period of twelve months from the date of ceasing to hold office.

COMMITTEE MEETINGS

20. (i) Meetings of the Committee shall be held at least once every month and at other times as the Chairman or the Committee shall decide.
- (ii) The attendance of at least half of the committee shall be necessary before any business shall be transacted. Decisions shall be by a simple majority of those present and voting. Each member shall have one vote, except that in case of equal voting the Chairman shall have a casting vote.
- (iii) The committee shall conduct the ordinary business of the Society and shall exercise the ordinary powers of the Society, except those reserved for the General Meeting, and shall in all its transactions comply with the Co-operative Societies Act (Chapter 193), the Regulations made thereunder, these by-laws, and in particular shall have the following duties.
- a) to maintain or cause to be maintained true and accurate accounts of all moneys received and expended, of all goods bought and sold, of all the goods and assets of the Co-operative and of all business transacted by the Co-operative;
 - b) to examine the accounts and sanction expenditure subject to any decision of the General Meeting;
 - c) to keep a register of members correct and up-to-date to supervise the maintenance of the prescribed records, to consider the inspection notes of the Registrar and his officers, and any reports presented for consideration by officers of the Ministry of Mines, and the ZMDC, and to take necessary action thereon and report to the authority from which the report emanated;
 - d) to prepare and lay before the Annual General Meeting an income and expenditure account and an audited balance sheet;
 - e) to elect new members to the Co-operative;
 - f) to call Annual and other General Meetings in terms of these by-laws;
 - g) to arrange the terms on which the business transactions of the Co-operative shall be conducted and to ensure the safe custody of the Co-operative's goods and property.

REGISTERS

21. The Co-operative shall maintain in proper order the following registers and documents;
- i) a register of members, showing name, address, occupation, membership number, date of admission and date of termination of membership;
 - ii) a cash book showing receipts of all moneys and all expenditure;
 - iii) ledgers;
 - iv) minute books for General Meetings and for Committee meetings;
 - v) a daily attendance register and records of daily production;
 - vi) In terms of section 52 of the Co-operative Societies Act only the Minister through the Registrar of Co-operative Societies may from time to time prescribe such other records and registers as may be necessary.

DISPUTES

22. Any disputes not resolved by the Committee or in General Meeting in regard to these by-laws or the business of the Co-operative between members or past members of the Co-operative or persons claiming through them, or between such persons and the Committee or any officer of the Co-operative, shall be referred to the Registrar and dealt with under Part VII of the Co-operative Societies Act (Chapter 193). Any decisions of the Registrar or arbitrator appointed by him in terms of the law shall be carried out by the Committee.

LIQUIDATION

23. The Co-operative shall be liquidated only as provided for by Part VI of the Co-operative Societies Act (Chapter 193).

GENERAL

24. Every member of the Co-operative shall accept and faithfully comply with these by-laws, the Co-operative Societies Act (Chapter 193) and the Co-operative Societies Regulations made thereunder, and with all amendments hereto.

Source: Zimbabwe Mining Development Corporation. Harare.
(Zimbabwe).

APPENDIX D

Employees and Earnings by Industrial Sectors

EMPLOYEES AND EARNINGS BY INDUSTRIAL SECTORS*

| | Agriculture, Forestry and Fishing | Mining and Quarrying | Manufacturing | Electricity and Water | Construction | Finance, Insurance and Real Estate | Distribution, Restaurants and Hotels | Transport and Communications | Services | | | | | Total |
|------------------------|-----------------------------------|----------------------|---------------|-----------------------|--------------|------------------------------------|--------------------------------------|------------------------------|-----------------------|-----------|--------|------------------|-------|-------------------|
| | | | | | | | | | Public Administration | Education | Health | Private Domestic | Other | |
| EMPLOYEES | | | | | | | | | | | | | | <i>\$ million</i> |
| Annual averages | | | | | | | | | | | | | | |
| 1965 | 293.6 | 47.1 | 80.7 | 4.9 | 27.2 | 7.9 | 60.8 | 33.3 | 29.9 | 29.1 | 9.1 | 94.7 | 15.2 | 747.3 |
| 1966 | 278.4 | 46.5 | 80.5 | 5.1 | 27.8 | 7.9 | 56.1 | 33.8 | 31.8 | 30.2 | 9.4 | 95.7 | 17.8 | 733.0 |
| 1967 | 277.6 | 50.5 | 84.3 | 5.2 | 28.5 | 8.1 | 58.0 | 34.4 | 33.9 | 29.3 | 9.8 | 97.8 | 29.2 | 750.6 |
| 1968 | 288.6 | 51.7 | 95.8 | 5.5 | 34.2 | 8.2 | 61.8 | 34.2 | 35.3 | 30.2 | 10.2 | 102.0 | 30.1 | 790.0 |
| 1969 | 307.5 | 54.2 | 104.2 | 5.3 | 39.6 | 8.9 | 65.4 | 35.4 | 37.6 | 30.9 | 10.2 | 105.4 | 30.9 | 833.3 |
| 1970 | 317.0 | 57.2 | 114.7 | 5.6 | 42.4 | 9.0 | 63.6 | 34.5 | 39.0 | 31.0 | 10.7 | 109.3 | 34.8 | 853.3 |
| 1971 | 310.9 | 58.0 | 121.6 | 5.8 | 44.8 | 9.4 | 67.3 | 38.9 | 39.6 | 31.0 | 11.4 | 114.0 | 36.1 | 891.0 |
| 1972 | 342.3 | 58.4 | 130.7 | 6.1 | 49.5 | 10.4 | 72.1 | 41.0 | 40.1 | 31.9 | 12.1 | 119.4 | 38.9 | 932.9 |
| 1973 | 356.6 | 58.1 | 139.4 | 6.6 | 56.8 | 11.1 | 76.7 | 42.3 | 41.4 | 32.3 | 12.5 | 122.6 | 40.1 | 977.3 |
| 1974 | 345.6 | 62.0 | 151.3 | 6.9 | 64.3 | 11.6 | 76.2 | 43.8 | 43.4 | 34.7 | 13.0 | 124.4 | 42.7 | 1009.9 |
| 1975 | 343.8 | 62.6 | 156.0 | 6.9 | 68.8 | 12.1 | 77.3 | 43.3 | 44.9 | 34.0 | 13.3 | 124.1 | 42.9 | 1050.2 |
| 1976 | 356.1 | 63.8 | 153.6 | 6.7 | 71.6 | 12.1 | 74.7 | 45.7 | 43.8 | 34.9 | 13.5 | 122.8 | 42.1 | 1033.4 |
| 1977 | 348.2 | 61.6 | 145.1 | 6.6 | 66.5 | 12.2 | 72.5 | 43.5 | 40.6 | 34.6 | 14.3 | 120.0 | 42.3 | 1012.2 |
| 1978 | 341.4 | 58.1 | 139.3 | 6.5 | 69.9 | 12.0 | 69.1 | 44.0 | 40.3 | 34.9 | 14.7 | 115.9 | 41.1 | 984.3 |
| 1979 | 333.2 | 59.5 | 144.7 | 6.6 | 68.6 | 12.1 | 67.6 | 43.4 | 43.7 | 33.8 | 14.8 | 110.4 | 42.8 | 964.7 |
| 1980 | 337.0 | 64.2 | 159.4 | 6.7 | 62.2 | 12.5 | 70.3 | 45.4 | 41.9 | 34.2 | 15.2 | 108.0 | 43.8 | 1009.9 |
| 1981 | 294.3 | 68.2 | 173.2 | 6.6 | 47.1 | 13.8 | 73.0 | 49.1 | 42.2 | 39.1 | 16.3 | 104.6 | 47.2 | 1037.7 |
| 1982 | 274.3 | 62.7 | 180.5 | 6.5 | 51.1 | 14.6 | 79.8 | 50.4 | 41.3 | 41.0 | 16.9 | 101.4 | 51.7 | 1045.9 |
| 1983 | 263.5 | 60.3 | 173.4 | 6.9 | 49.3 | 15.8 | 80.6 | 49.6 | 42.5 | 42.2 | 19.0 | 99.8 | 54.5 | 1031.4 |
| 1984 | 271.2 | 54.5 | 164.3 | 7.2 | 45.2 | 13.7 | 80.2 | 50.1 | 40.9 | 43.8 | 19.9 | 98.0 | 53.2 | 1026.4 |
| 1985 | 271.2 | 54.3 | 169.6 | 7.7 | 44.8 | 13.3 | 78.3 | 50.0 | 40.8 | 43.9 | 20.8 | 98.9 | 59.6 | 1026.4 |
| As of: | | | | | | | | | | | | | | |
| 1986 March | | 55.1 | 172.5 | 7.8 | 49.7 | 15.2 | 78.5 | 50.1 | 40.3 | 44.5 | 22.2 | 99.8 | 60.9 | |
| June | | 54.8 | 177.0 | 8.2 | 46.1 | 15.2 | 81.0 | 51.1 | 40.5 | 45.6 | 21.5 | 99.9 | 62.6 | |
| EARNINGS | | | | | | | | | | | | | | <i>\$ million</i> |
| Periods | | | | | | | | | | | | | | |
| 1965 | 32.3 | 23.2 | 44.1 | 5.6 | 17.3 | 13.3 | 37.1 | 32.9 | 33.7 | 23.8 | 8.1 | 22.7 | 22.3 | 400.7 |
| 1966 | 48.7 | 24.7 | 44.7 | 5.8 | 17.5 | 16.4 | 34.1 | 38.0 | 37.7 | 25.6 | 9.1 | 23.3 | 24.0 | 411.7 |
| 1967 | 49.0 | 25.9 | 73.4 | 4.2 | 18.4 | 17.2 | 36.8 | 38.8 | 40.1 | 26.6 | 9.4 | 24.8 | 25.7 | 452.9 |
| 1968 | 49.9 | 27.9 | 82.5 | 6.9 | 23.9 | 19.0 | 42.7 | 37.5 | 43.6 | 28.9 | 10.3 | 26.4 | 27.3 | 470.8 |
| 1969 | 32.8 | 31.7 | 94.7 | 7.1 | 26.3 | 21.3 | 44.7 | 61.8 | 49.0 | 31.6 | 11.1 | 27.7 | 32.8 | 514.3 |
| 1970 | 33.3 | 35.4 | 107.8 | 7.5 | 31.5 | 22.9 | 71.8 | 65.0 | 51.8 | 32.8 | 12.0 | 30.2 | 35.9 | 539.8 |
| 1971 | 34.3 | 37.1 | 120.1 | 9.3 | 40.8 | 25.0 | 81.9 | 70.9 | 58.6 | 39.2 | 14.3 | 32.9 | 38.0 | 624.5 |
| 1972 | 42.6 | 38.0 | 141.8 | 10.4 | 46.3 | 30.6 | 89.8 | 77.9 | 65.8 | 42.7 | 16.9 | 35.2 | 41.9 | 699.1 |
| 1973 | 70.7 | 40.3 | 160.7 | 11.7 | 49.9 | 33.8 | 98.8 | 85.6 | 77.5 | 47.7 | 17.7 | 37.0 | 49.9 | 781.3 |
| 1974 | 80.6 | 48.2 | 193.3 | 13.3 | 62.9 | 41.0 | 107.3 | 95.4 | 91.3 | 54.6 | 20.4 | 39.9 | 54.2 | 904.3 |
| 1975 | 93.4 | 57.1 | 226.6 | 15.6 | 69.1 | 44.9 | 124.9 | 108.4 | 109.1 | 64.5 | 24.4 | 45.8 | 63.8 | 1049.6 |
| 1976 | 103.2 | 65.7 | 244.9 | 17.0 | 62.2 | 51.1 | 130.4 | 121.5 | 140.5 | 72.2 | 27.3 | 48.5 | 68.3 | 1153.8 |
| 1977 | 112.3 | 71.4 | 253.3 | 18.7 | 61.5 | 53.2 | 135.8 | 128.0 | 160.1 | 74.0 | 30.5 | 50.9 | 73.8 | 1247.4 |
| 1978 | 120.1 | 72.6 | 267.0 | 20.7 | 57.8 | 57.4 | 138.1 | 133.7 | 215.3 | 85.8 | 34.8 | 52.1 | 77.6 | 1323.0 |
| 1979 | 137.8 | 85.4 | 307.0 | 22.1 | 64.1 | 64.3 | 152.6 | 147.8 | 243.5 | 97.7 | 39.0 | 53.2 | 87.1 | 1501.6 |
| 1980 | 149.7 | 116.2 | 401.8 | 26.2 | 77.8 | 78.5 | 187.6 | 188.7 | 262.3 | 168.3 | 46.6 | 64.7 | 109.6 | 1881.0 |
| 1981 | 219.1 | 157.3 | 539.9 | 30.0 | 105.6 | 99.3 | 245.4 | 237.8 | 280.8 | 216.1 | 55.7 | 72.3 | 135.4 | 2394.6 |
| 1982 | 252.0 | 178.7 | 651.4 | 34.2 | 138.2 | 116.2 | 299.8 | 275.7 | 329.6 | 309.8 | 75.8 | 85.4 | 170.1 | 3117.2 |
| 1983 | 279.5 | 186.0 | 709.7 | 38.1 | 154.2 | 128.2 | 335.9 | 279.5 | 347.7 | 344.1 | 76.0 | 88.5 | 191.8 | 3169.2 |
| 1984 | 319.1 | 194.0 | 762.7 | 46.3 | 160.5 | 151.1 | 355.0 | 295.2 | 391.1 | 416.3 | 90.7 | 84.9 | 211.1 | 3480.0 |
| 1985 | | 221.3 | 886.1 | 58.0 | 165.5 | 162.6 | 409.2 | 324.4 | 429.5 | 524.4 | 112.3 | 94.3 | 250.0 | |
| 1986 1st Quarter | † | 58.6 | 232.1 | 14.1 | 42.4 | 44.6 | 104.5 | 87.0 | 111.9 | 139.0 | 31.8 | 31.8 | 64.5 | |
| 2nd Quarter | † | 58.1 | 243.0 | 16.3 | 43.7 | 44.4 | 108.3 | 91.9 | 117.8 | 148.2 | 30.7 | 29.3 | 68.4 | |

* Because of collection difficulties these figures exclude the employees of small agricultural units and small businesses in rural areas. At the date of the 1969 Census, these small units had a total of 30 600 employees, 50 per cent. of whom were agricultural workers.
 † Available on an annual basis only.

| Period | Bulawayo | Gweru | Harare | Kadoma | Kwekwe | Masvingo | Mutare |
|----------------------------|----------|-------|---------|--------|--------|----------|--------|
| EMPLOYEES | | | | | | | |
| <i>thousand</i> | | | | | | | |
| Annual Average: | | | | | | | |
| 1969 | 102,8 | 17,6 | 178,1 | 7,5 | 11,4 | 6,1 | 17,7 |
| 1973 | 127,3 | 22,3 | 243,1 | 9,0 | 14,3 | 9,7 | 22,4 |
| 1974 | 131,6 | 23,6 | 255,0 | 8,8 | 15,4 | 8,7 | 22,5 |
| 1975 | 134,2 | 24,8 | 259,3 | 8,7 | 16,5 | 9,6 | 22,9 |
| 1976 | 132,1 | 24,9 | 251,7 | 8,9 | 16,8 | 10,3 | 22,1 |
| 1977 | 129,2 | 24,2 | 245,6 | 8,6 | 16,2 | 10,9 | 21,1 |
| 1978 | 125,5 | 23,2 | 241,4 | 8,2 | 15,8 | 10,6 | 22,0 |
| 1979 | 128,9 | 23,9 | 244,8 | 8,3 | 16,0 | 10,8 | 21,8 |
| 1980 | 133,0 | 24,9 | 254,5 | 8,5 | 17,5 | 9,6 | 22,2 |
| 1981 | 140,5 | 25,0 | 264,5 | 9,4 | 19,0 | 9,4 | 24,0 |
| 1982 | 144,8 | 25,9 | 274,7 | 9,9 | 18,1 | 9,9 | 24,7 |
| 1983 | 137,7 | 25,2 | 273,1 | 10,0 | 18,0 | 10,0 | 23,1 |
| 1984 | 137,3 | 25,5 | 275,3 | 10,1 | 17,9 | 9,9 | 25,2 |
| 1985 | 133,4 | 25,0 | 284,4 | 10,0 | 18,9 | 10,1 | 25,6 |
| At end of: | | | | | | | |
| 1986 March | 133,0 | 25,0 | 287,3 | 10,0 | 19,9 | 10,2 | 26,6 |
| June | 136,6 | 25,8 | 289,1 | 10,4 | 20,0 | 10,5 | 26,1 |
| EARNINGS | | | | | | | |
| <i>\$ million</i> | | | | | | | |
| 1973 | 152,3 | 25,9 | 330,7 | 8,0 | 18,0 | 9,4 | 23,2 |
| 1974 | 167,3 | 31,3 | 385,6 | 8,6 | 21,4 | 9,5 | 25,7 |
| 1975 | 197,9 | 36,0 | 441,7 | 9,3 | 27,9 | 11,4 | 29,5 |
| 1976 | 220,0 | 42,0 | 482,5 | 10,4 | 33,0 | 13,7 | 31,5 |
| 1977 | 239,7 | 44,6 | 520,9 | 11,2 | 34,9 | 16,0 | 33,2 |
| 1978 | 254,5 | 47,6 | 557,3 | 12,1 | 39,8 | 17,4 | 37,5 |
| 1979 | 284,6 | 53,8 | 620,8 | 14,1 | 44,5 | 19,3 | 42,2 |
| 1980 | 343,7 | 65,6 | 757,3 | 17,5 | 56,7 | 22,0 | 51,6 |
| 1981 | 425,9 | 76,5 | 911,8 | 22,8 | 71,7 | 24,6 | 65,3 |
| 1982 | 513,6 | 93,4 | 1 098,9 | 27,7 | 75,7 | 31,6 | 80,3 |
| 1983 | 536,9 | 97,3 | 1 197,4 | 30,2 | 84,1 | 32,5 | 84,1 |
| 1984 | 557,6 | 108,1 | 1 275,2 | 33,5 | 91,5 | 36,4 | 91,7 |
| 1985 | 627,0 | 118,6 | 1 494,4 | 38,3 | 111,4 | 44,2 | 107,4 |
| 1986 1st Quarter | 164,1 | 31,4 | 388,8 | 9,8 | 33,0 | 11,2 | 29,4 |
| June | 166,7 | 32,8 | 418,0 | 10,5 | 33,6 | 12,0 | 29,9 |

Source: Zimbabwe Central Statistical Office, Quarterly

Digest Of Statistics. Harare. Zimbabwe Government.

APPENDIX E

Plant Purchased Through Plant Hire

| <u>DESCRIPTION</u> | <u>CODE</u> | <u>AMOUNT (€)</u> |
|--|-------------|-------------------|
| 140 CFM Ingersoll Rand Compressor on C/W Perkins Diesel | C 257 | 17 550,00 |
| Two R 4772 Rock Drills C/W Air and Water Hoses RD Compound | RD 1 | 1 401,50 |
| Oil Couplings and Drill Steels | RD 2 | 1 401,50 |
| 20 Lengths 20LB Rails | 20LB Rails | 600,00 |
| One Jack Leg (Pusher C/W Lateral Hoses) | | 650,00 |
| Six Rope Rollers | | 60,00 |
| Bolts, Dog Skipes and Fish Plates | | 260,00 |
| Two Wheel Barrows | | 140,00 |
| Water Blast | | 40,00 |
| Blow Pipe | | 30,00 |
| One 24" Jackleg (Pusher) | | 500,00 |
| One FC 22-1 Paving Breaker and Chipping Hammer | PB 1 | 610,00 |
| One ½ Tonne Cocopan | CP 263 | 100,00 |
| One ½ Tonne Cocopan | CP 264 | 100,00 |
| One 20LBS Points on Switch | PS 1 | 70,00 |
| Two Lengths 20LBS Rails | 20LBS Rails | 30,00 |
| 20 Lengths 50mm Second Hand Black Medium Piping | 50mm Piping | 220,00 |
| One Drill Steel Sharpener | DS 1 | 1 875,00 |
| 30 Lengths 20LB Second Hand Rails | 20LB Rails | 450,00 |
| 8mm SWR Wire Rope on Atlas Copco Air Hoist | W 3 | 4 250,00 |
| Grand Total | | <u>€30 567,50</u> |