First cycle experience of a business process re-engineering programme at Shabanie Mine

by C. Musingwini*, C. Muzoriwa†, D. Phuti‡, and D. Mbirikira§

Synopsis

In the past ten to fifteen years, many organizations have applied business process re-engineering (BPR) to significantly improve their business competitiveness or stave off closures. The mining industry in Southern Africa is no exception and documented examples can be drawn from South Africa. Although the concept is superficially simple, its application has been marked by a high failure rate of about 70 per cent because it has been generally misunderstood. Shabanie mine, a chrysotile asbestos fibre producer in Zimbabwe took cognisance of this fact by cautiously embarking on a modular BPR programme in October of 2002. A year was used as a complete cycle or module for re-evaluation of the programme.

Shabanie mine adopted BPR as part of management efforts to remain competitive amid serious threats to operational viability. These threats included hyper-inflation driven rising production costs, a declining world asbestos market and a possibility that Russia could take over the shrinking world asbestos market by dumping low-priced asbestos fibre. The only competitive advantage that the mine had was the high quality of its long-fibre chrysotile asbestos. The major BPR thrust was therefore to redesign processes for improved productivity and ultimately achieve a lower cost per ton of final asbestos fibre product. In addition, corporate culture change and cost-saving were also factored into the programme.

This paper discusses the implementation experience of the BPR programme at the mine. The main BPR beneficial highlights are improved productivity, sizeable cost-savings, positive corporate culture change and identification of secondary projects. One of the lessons learnt from this programme is that mining companies will have to deal with the HIV/AIDS pandemic if they are to sustain high levels of productivity into the future.

Introduction

The mining environment has been changing continuously, bringing new challenges and increased competition. In the past ten to fifteen years, environmental and social pressure groups have become stronger and their campaigns have in some cases pushed up production costs, while the prices of some minerals have been sluggish or even declined in real terms, eroding profitability. Mineral products continue to be threatened with substitution, for example asbestos with synthetic fibres. Adopting business process re-engineering (BPR) is one way that some mining companies have addressed these challenges to remain in business. The mining industry in Southern Africa also responded to this challenge by re-engineering their operations, and documented examples can be drawn from South Africa from as early as 1991[1–3]. Although some mining literature may not have directly referred to the term BPR, terms such as 'innovative approach', 'organizational restructuring', 'rationalization' and 'recovery' have been used to describe these efforts. It is now not uncommon in mining houses to find titles such as 'business area manager' for a general or mine manager and 'strategic business unit' for a division, in line with re-engineering nomenclature.

BPR is a concept that emerged in business lexicons around 1990. Several experts in the field of change management have defined BPR in nearly the same manner. Davenport and Short[4] defined BPR as 'the analysis and design of workflows and processes within and between organizations'. Teng, Grover and Fielder[5] defined BPR as 'the critical analysis and radical redesign of existing business processes to achieve breakthrough improvements in performance measures'. Malhotra[6] defined BPR as 'the discrete initiatives that are intended to achieve radically redesigned and improved work processes in a bounded time frame'. Implicit in these definitions is that BPR entails the evaluation and redesign of business processes to achieve significant improvements in critical measures of performance such as cost, quality, speed and innovation in product delivery to the market.

* *School of Mining Engineering, University of the Witwatersrand, Johannesburg, South Africa.*

† *Department of Mining Engineering, University of Zimbabwe, Harare, Zimbabwe.*

‡ *AA Mines Corporate Office, Zvishavane, Zimbabwe.*

§ *Shabanie Mine, Zvishavane, Zimbabwe.*

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Although more than a decade has passed since its inception, BPR has been generally misunderstood and in some instances equated solely with restructuring or downsizing. As a result, Malhotra[6] reports that over 70 per cent of the re-engineering projects have failed mainly because of lack of clarity on BPR. The failure is not only about failing to achieve significant positive change but also failing to sustain that change. Other reasons for failure included lack of sustained management commitment, disempowered employees, inadequate project budgets, unrealistic scope and expectations, resistance to change and viewing BPR as merely a cost-cutting exercise.

Justification for BPR introduction

Shabanie mine in Zvishavane is one of the two chrysotile asbestos fibre-producing mines in Zimbabwe. The desire by the mine to embark on a BPR programme arose out of several factors, the most important of which were:

- A declining world asbestos market since the 1990s due to strong international anti-asbestos campaigns and the introduction of synthetic products to substitute for asbestos. Accordingly, most producers have had to maintain, reduce or cease production, resulting in an overall declining world production (Figure 1). For Shabanie mine, this has meant maintaining production levels at ±150,000 t/month run-of-mine (ROM) ore at a grade of about 4 per cent fibre, but land the product on the market at lower cost per ton
- The existence of a threat that Russia, with abundant open-pitiable asbestos reserves and producing about 50 per cent of total world annual output, but controlling only about 15 per cent of the export market, could flood the market with low-priced asbestos fibre. This would definitely push high-cost producers out of business. For Shabanie mine to survive such a possibility, it had to produce its asbestos fibre at lower cost per ton
- The post-1995 period in Zimbabwe has been marked by relatively high inflation that peaked at 622 per cent in January 2004[7], causing production costs to rise quite significantly. Shabanie mine grappled with this post-1995 phenomenon by downsizing labour, which had been the single highest cost category at 44 per cent of total mine costs, to improve productivity and derive significant cost savings. However, the gains made in ROM ore productivity were marginal and appeared to stagnate in the range 40 t/man/month–45 t/man/month, averaging 42.4 t/man/month between March 2000 and March 2001 (Figure 2). The finished fibre productivity averaged 1.7 t/man/month during that period, but was beginning to decline. It was clear that downsizing labour alone had reached its limits and a new survival strategy was required to lower the cost per tonne.

Despite these major threats, Shabanie mine had a competitive advantage over other producers because its long-fibre chrysotile asbestos is of a high quality[8]. The good fibre quality is believed to be partly the reason why, despite being the world's fifth largest producer (Figure 1), Zimbabwe ranks as the world's second largest exporter of asbestos fibre, after Canada, which controls nearly 50 per cent of the export market. An added advantage was the fact that none of the synthetic products produced could be as versatile and cost-effective as asbestos. However, the threats required the mine to seek a more holistic and sustainable survival strategy. The mine therefore, in mid-2002, engaged the advisory services of the Department of Mining Engineering at the University of Zimbabwe and it was agreed that these challenges could best be addressed by developing and implementing a BPR programme on the mine.

Earnest implementation of the programme began in October 2002 and was expected to increase the productivity of the operation, positively change the business culture on the mine and result in significant cost savings. This would ensure that the mine would be able to continue to land the product on the market at lower cost per ton.

Approach to BPR

A BPR programme is not a single event but a continuous cycle (Figure 3), designed for continuous improvement in performance. Most companies have used either of two possible approaches to BPR, namely the exhaustive and high-impact approaches. The exhaustive approach is where all the processes within an organization are identified and then prioritized in order of redesign urgency. In the high-

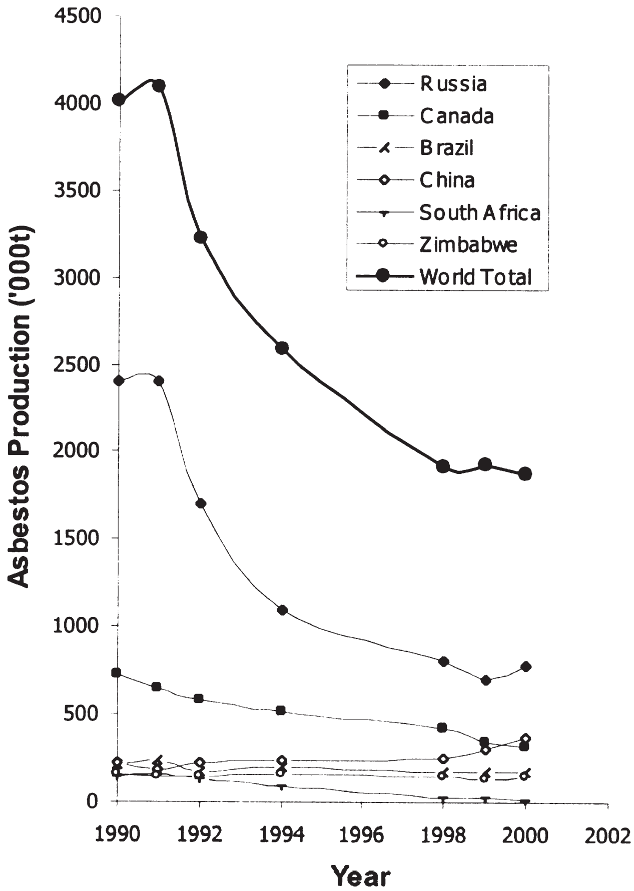

Figure 1—World production trend of major asbestors producers

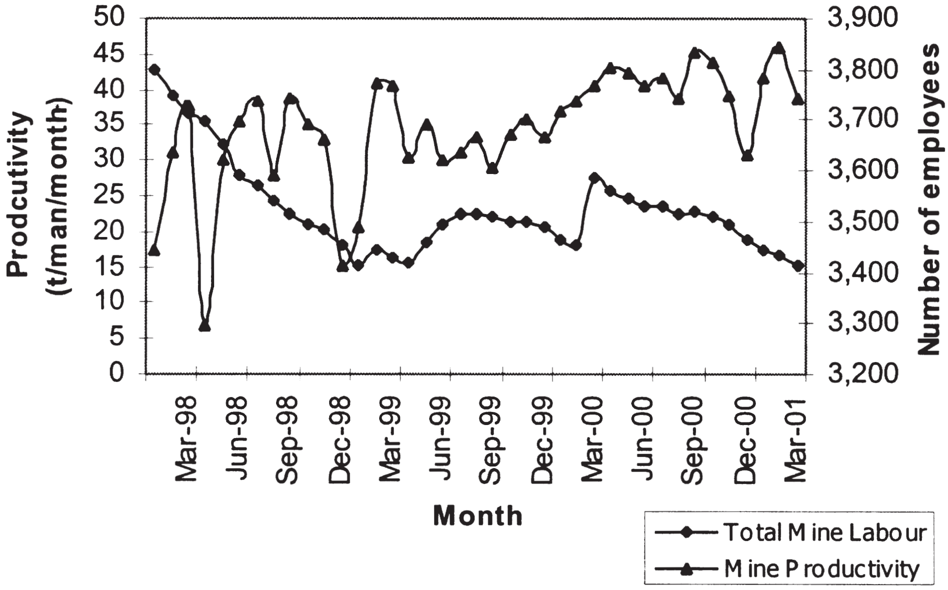

Figure 2—Labour-productivity relationship for Shabanie mine (1998–2001)

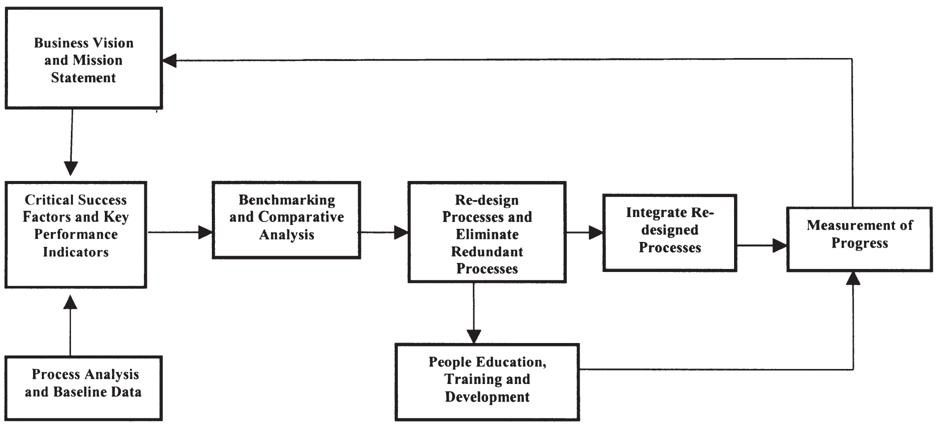

Figure 3—Simplified BPR cycle for continuous improvement

impact approach redesign is only for the processes identified as the most important or as the most in conflict with the organization's business vision and key objectives.

Shabanie mine chose a modular, high-impact approach that ensured positive change occurred with minimal disruption to production, but following closely the methodology of Figure 3. In this approach only the most important processes with direct relevance to productivity and cost-saving took precedence. Each cycle (or module) was chosen as a one-year period. One-year action programmes were then drawn up to redesign and monitor the 'new' business organization.

The first step taken was to set up a BPR team comprising carefully selected departmental representatives headed by a management representative, the technical services manager. This team was mandated to drive the programme semi-autonomously at departmental level. Autonomy was necessary to minimize chances of carrying over the existing status quo by departmental heads. The team then analysed the company's mission statement for translation into objectives of the programme. For example, the extract from the mission statement 'We produce consistent, high quality chrysotile asbestos at the lowest possible cost for distribution throughout the world' was translated into realistic cost-saving targets (Table I).

The BPR team, with the participation of each department, then undertook a vertical column analysis of each department. This was achieved by:

- Process flow-charting each department's processes showing process inputs and outputs. These were then compiled in a register. Figure 4 shows a sample extract from the flow chart register. Summary and trend data for process inputs and outputs were appended into the register, so that declining efficiencies or increasing waste outputs could be identified as these had direct relevance to productivity and cost saving. The data also constituted baseline data against which future performance improvements would be evaluated

Table I

Main BPR programme areas

Department	BPR cost savings		% of target achieved	Main BPR programme areas
	Plan ($m)	Actual (z$m)		
Mining	23.40	20.97	89.62	• Savings on overtime • Change explosive used from emulsion-type to Anfex for both down and up fans • Reduce numbers of drills and LHDs by using higher generation equipment • Review support installed to reduce over-supporting in areas • Re-use suitable materials
Milling	5.85	2.12	36.24	• Purchase used spared from mines that have ceased operations • Save on coal by ensuring more effective combustion • Power saving by regulating airflow fans in the suction section • Inrease effectiveness of plastic wrapping • Reduce quantity of production failures
Engineering	5.58	4.19	71.62	• Savings on stationery through use of IT • In-house manufacture of components • Improved power management • Purify and recycle used oils
Finance	1.88	1.20	63.83	• Savings on overtime • Savings on stationery through use of IT • Reduce creditor payment period to save interest charges • Minimize misuse of telephone
Purchasing	1.17	0.59	50.43	• Savings on overtime • Savings on stationery through use of IT • Maximize use of rail system for moving product to markets and reduce use of road haulage
Human resources	1.00	1.50	150.00	• Savings on overtime • Direct inputs at source, for payrolls • Training on site instead of sending employees to other firms
Mine total or ave.	39.15	30.57	78.08	

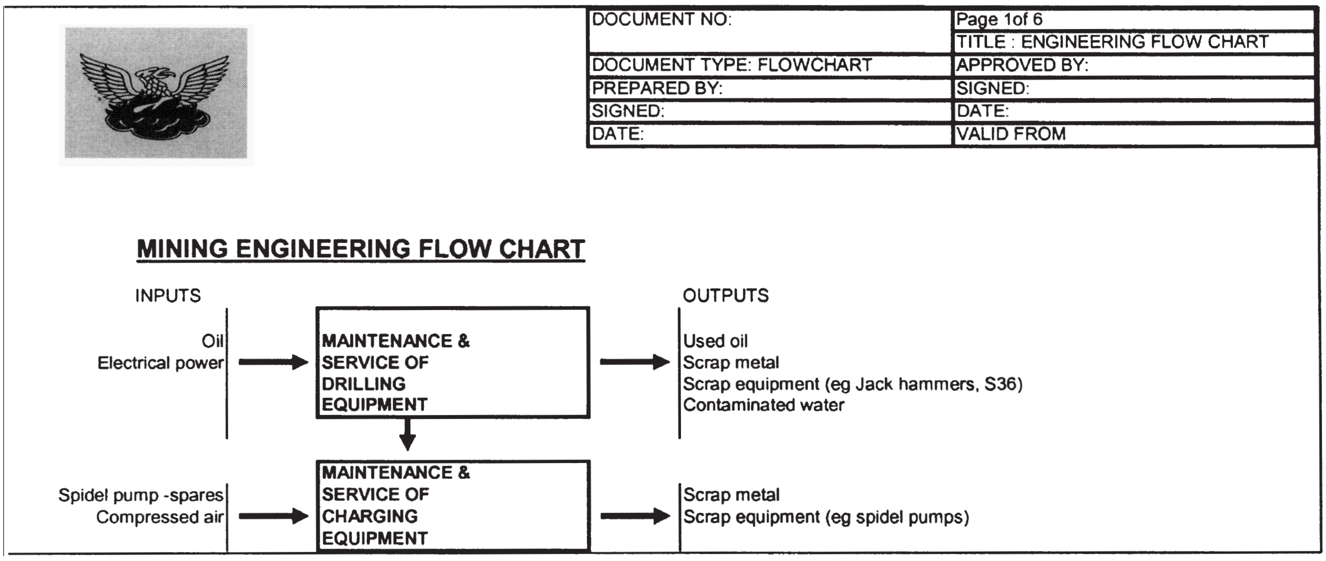

Figure 4—Extract from mining engineering services department flow chart

- The processes were then benchmarked against industry standards and best operating practices to identify the processes that were performing well below similar processes in other mines or asbestos producers. These processes were then extracted from the register and action programmes developed for them. For example, most asbestos producers had productivities ranging from 2.7 t/man/month–10 t/man/month compared to Shabanie's average of 1.7 t/man/month. This meant the mine productivity needed to rise at least twofold to bring the mine on a par with other asbestos producers[9]. This increase was realistically assessed to be achievable over 3 cycles (i.e. at 67 per cent per year)
- Redundant processes and areas of unclear responsibility were then identified and resolved or eliminated.

Programmes that required implementation across departments were identified in a subsequent stage called horizontal integration where all reviewed processes were then integrated. This was necessary to ensure that cross-departmental cooperation was enlisted before the action programmes were rolled out. For example, responsibility for production loss had previously been a conflict area between mining and engineering services, with each department blaming the other for machinery breakdown. This was resolved by introducing an action programme to establish a production-based bonus award system that included engineering service and mining personnel as one team. Lastly, Shabanie mine realized that the successful execution of redesigned processes depended upon its employees. Accordingly, the mine launched a 'Come-on-Board' programme to educate employees on the importance of their acceptance, participation and ownership of the BPR project. This 'human factor' in organizational change is also resonated by Fourie[1] and Brownrigg[2] in their re-engineering encountered.

A review was then undertaken in 2004 to assess the success of the programme's first implementation cycle and the findings are discussed in the next section.

Analysis of BPR impact

The three major areas of focus were productivity, cost saving and culture change. The productivity trends for the main production departments, mining and milling, and the entire mine were tracked. The results are shown in Figures 5, 6 and 7. It can be seen that just before BPR implementation, productivity was coming down and continued to do so in the transition period October 2002 to December 2002. From December 2002 to November 2003 mine productivity increased from 1.4 t/man/month fibre to 2.3 t/man/month fibre (i.e. a 64 per cent increase in productivity). However, it started to decline from November 2003. This was an indication of internal problems in sustaining the programme. Apparently, productivity was coming down due to fewer shifts being worked in a month because more sick leave was being taken. This was attributed to an increasing impact of HIV/AIDS pandemic. As a result, the mine started to look at ways of combating this problem and providing anti-retrovirals may be an option for the mine to follow in the long-term. Additionally, ways are being sought to reduce traveling time to workplaces in order to increase the effective shift time. Clearly, HIV/AIDS will have a long-term negative effect on the productivity of mines.

Evaluation of cost savings was not easy because of the hyper-inflationary economic environment and a managed exchange rate. However, the approach taken was to consider material savings over the period and convert them to nominal

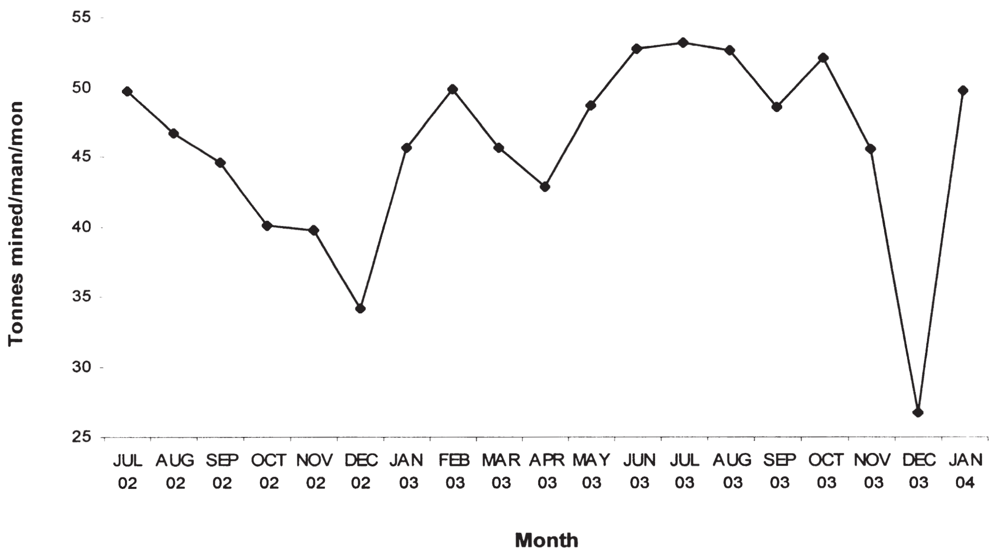

Figure 5—Trend in mining department productivity

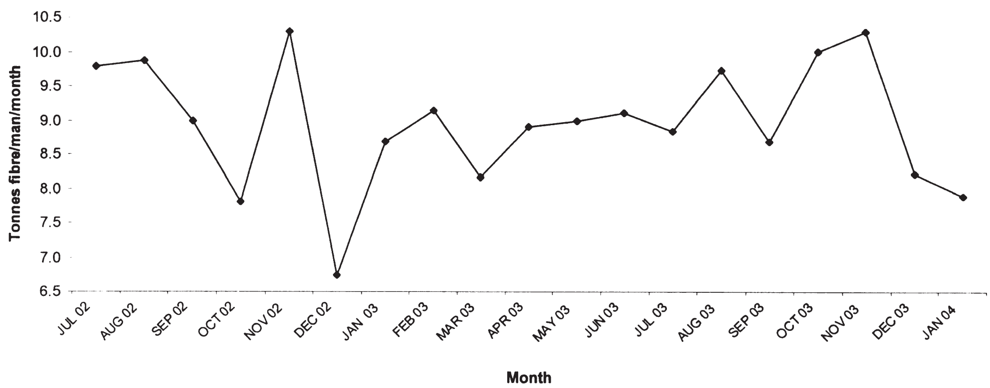

Figure 6—Trend in milling department productivity

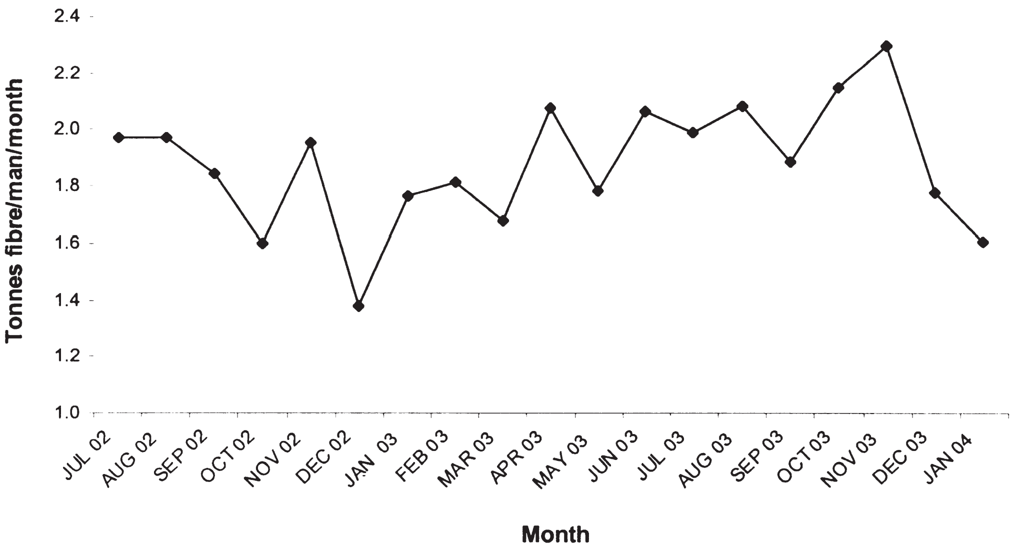

Figure 7—Trend in mine productivity

Table II

Employees category perception of BPR impact on organization performance

Employee grade	Very much	High	Moderate	Low	Very little	No comment
Operatives	49%	24%	9%	5%	11%	2%
Supervisors	46%	17%	10%	10%	10%	7%
Management	20%	44%	28%	4%	0%	4%
Total mine	41%	27%	14%	6%	8%	4%

Table III

Departmental category perception of BPR impact on organization performance

Departmental grade	Very much	High	Moderate	Low	Very little	No comment
Mining	26%	18%	24%	23%	3%	6%
Milling	22%	17%	22%	22%	0%	17%
Technical services	7%	40%	40%	7%	0%	7%
Engineering services	0%	20%	60%	20%	0%	0%

monetary terms. A commendable average of 78 per cent of target cost savings was achieved (Table I). This indicates that the targets set were fairly realistic, one of the requirements of BPR. The actual cost per ton is proprietary information and only a percentage change can be reported. Over the period it rose by 26 per cent in nominal terms against an inflation rate of 622 per cent, implying that a reduction in the cost per ton occurred in real monetary terms.

The most difficult area in which to assess the impact of BPR was corporate culture change as it tends to be more qualitative than quantitative. A questionnaire was circulated to all departments to get feedback on employee perceptions and reception of the programme. The results of the survey were then categorized by employee grade (Table II) and production-related departments (Table III). The responses from the employees on the success of the BPR programme at Shabanie mine were mixed. Surprisingly, least confidence in the programme came from management employees, probably because they felt they did not 'own' it, since it was driven by a semi-autonomous team. This could have negative consequences on the continued sustainability of the programme on the mine and could partly be the reason for the decline in productivity from November 2003. The milling department had the greatest percentage of employees who were indifferent to the programme, indicating their little involvement in the programme implementation. Overall, the programme seemed to be reasonably received, with 68 per cent of the employees (i.e. those responding 'very much' and 'high') conceding that the BPR strategy had a positive effect on the mine and was aligned with performance improvement.

Major BPR benefits

The results achieved during the first cycle implementation of the BPR programme at Shabanie mine are quite encouraging. The BPR benefits are grouped into direct benefits and long-term secondary projects arising from the programme implementation. The highlights are summarized below.

- Cost savings of about Z$30.57m in nominal monetary terms over the cycle
- Mine productivity increase of 64 per cent
- Programme acceptance by 68 per cent of the employees
- 26 per cent increase in nominal cost per ton of asbestos fibre against inflation rate of 622 per cent
- Power savings of 2 MWh per month achieved by regulating airflow fans in the suction section of the milling plant
- Stationery savings through culture change from paper-based communication to electronic based IT communication within the mine.

Long-term secondary projects were a natural sequel to the BPR process. Three secondary projects were identified although they are still in their embryonic stages of implementation, largely due to capital restrictions. The first two had potential for cost saving while the third had a potential to become a secondary source of income for the mine. These are briefly explained below.

- Shabanie mine had experienced a marked increase in the consumption of fiberizing hammers for the milling plant during 2002. Methods of improving the campaign lives of the hammers were to be investigated and hence reduce consumption of the hammers and ultimately save milling costs.
- Only about 40 per cent of coal feed into the chain grate stoker was undergoing complete combustion. With the steep increase in cost of coal and its transportation from Wankie Colliery, it was necessary to investigate the combustion parameters to optimize the stoker efficiency to save on the milling costs.
- Decades of mining and milling at Shabanie mine produced millions of tons of waste rock and serpentine fines (i.e. tailings) that were dumped onto several dumps. The dumps consist mainly of magnesium silicate at about 20 per cent and reasonable amounts of nickel. The BPR programme identified the potential to recover nickel and magnesium as separate products from the waste dumps. The Canadian-developed Magnola process is being investigated for possible application to recover magnesium from the dumps. The possibility of using appropriate binders to mould the magnesium silicate fraction together with chrome fines from nearby chrome mines to produce low-temperature foundry bricks is also being investigated. These two projects have the potential to generate secondary income for the mine and have long-term benefits of reducing the environmental costs of rehabilitating waste dumps, as these will become raw material for the new projects.

Concluding remarks

The BPR benefits derived from the first cycle implementation range from increased productivity, significant cost savings and a positive corporate culture change. The mine demonstrated that BPR can indeed bring positive change and benefits to an organization when the process is undertaken in cycles. It is then possible to allocate adequate resources and set realistic targets because the process is unbundled into manageable modules. Workers have to be empowered to own the process so that the entire organization sees BPR as a continuous process to effect positive change. It is also apparent from the programme that the mine will have to formulate sustainable HIV/AIDS abatement programmes if they are to sustain high productivity levels into the future.

Acknowledgements

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