THE SMALL MINE - CAN IT BE COMPETITIVE?

By

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ABSTRACT

Small mines exist because of a restricted deposit or a small market. With the right management at the present time the small mine can have lower total costs than larger mines. Charbon is an example of a small mine with a restricted deposit and a specialised product. The development which incorporates a unique rail loading facility and flexible coal preparation plant was achieved with a modest capital outlay and in record time.

To remain competitive in future with larger scale mines who seek increased production the small mine must achieve increased productivity through automation, higher speed equipment and a multiskilled workforce. Derogation of the industry, scrapping the Coal Industry Tribunal and the Joint Coal Board would benefit small mines greatly. Management of a small operation also requires multiskills which need to be supported by outside help in the form of consultants and temporary staff.

In the 21st century small mines will continue to provide a service to the market.

INTRODUCTION

Right through history there has been a concept that efficiency is synonymous with increasing scale of operation. The concept exists in politics with large centralised governments, in the military with huge armies, amongst academics espousing social policies and organised production and within private and public companies. However, there is a long record of the decline of big organisations and failures of grandiose schemes. Moves to decentralise government and large corporate management, privatisation of government controlled enterprises and management buyouts, right around the world, are a reminder that many think that big equals inefficient.

During the crisis the coal industry has been going through there has been much talk about rationalisation and the swing to large open cut mines. The theme of this symposium is on higher production coal mining systems and their implications. Large scale does not mean efficiency, it does not mean survival during a shakeout. Saxonscale has been a casualty; Quintette would close if the Japanese banks were economically rational. There always has been and always will be a place for the small scale operation. This paper examines the role of the small mine and how the small mine can remain competitive.

THE ROLE OF THE SMALL MINE

Small mines exist basically for two reasons:-

1. A small or geologically restricted deposit;
2. A small market.

A small market may exist because of location giving a cost advantage or because of the failures of large organisations to adequately service the market. These market factors can be summarised as follows:-

a) Location/price advantage;
b) Special products such as sized coal for the domestic market;
c) Special quality factors such as low ash, low phosphorus, etc;
d) Customers with limited demand; diversification of supply.

While the small mines may be able to command some price premium in the market, they have to remain competitive so that the large company does not decide to force them out of the market.
COST FACTORS

The major cost factors under a company's control are:
1. Capital costs;
2. Labour costs;
3. Maintenance and material supplies;
4. Overseas.

CAPITAL COSTS

These costs are the result of initial management decisions on a project. For both small and large mines, management can decide to minimise labour. An example is a mine with an input crusher and conveyors which replace the use of trucks. Such a decision is more likely to be taken by big mines because of the pressures on labour costs which are discussed below. However, this has the danger that the mines are locked into a particular technology. High capital expenditure will make them less responsive to change.

Capital costs are also affected by the choice of equipment. Open cut operations can use draglines, shovels, bucket excavators or scrapers. Large operations tend to be conservative in the choice of equipment because the providers of large amounts of capital such as banking syndicates want to have an assured return.

It is generally believed that capital costs per unit of throughput are reduced with larger scale equipment. This is a false impression. Smaller equipment which has high volume sales can be manufactured on a production line where automation can give cost benefits. Also competition is greater in high volume selling equipment. Figures 1 and 2 from K. Hunter, 1987, show that for shovels per unit of power input, large units are more expensive and per cubic metre large and small units have the same capital cost.

Breakdowns, accidents and downtime due to equipment moves turn management's minds to back-up equipment or multiple units which may be idle for considerable time increasing capital costs. Again, large mines with conservative management pressures are known for surplus equipment. Small mines with shorter distances have a choice of large equipment for multitasks or smaller dedicated equipment.

Finally with regard to the equipment for a small mine it is likely to be more saleable if a wrong decision has been made or is at the end of its life in a mine environment. Also there are the possibilities of purchasing goods second hand or surplus equipment for a small mine.

In summary a small mine in comparison to a large mine can be more innovative in the choice of equipment, has greater flexibility to change operations and buy or sell equipment. Also, less is expected of the small mine with regard to environmental safeguard and infrastructure contribution. The small mine thus has normally a lower capital cost per tonne of coal than the large mine.

LABOUR COSTS

Large mines tend to be more capital intensive but that does not mean labour costs are lower. With big machinery unions have the opportunity to demand multiple manning, restrictive work practices and skill margins.

A big workforce requires a large number of supervisors which in turn can lead to industrial relations problems. At a small mine the manager can get to know all his employees. They can work more like a team. Jobs such as safety, fire control, and first aid can be spread so there is more involvement and less need for supervision. Flexible work practices and teamwork will result in higher productivity.
At the same level of capital intensity the small mine should have an advantage. With high labour intensity the small mine may be able to offset the higher labour cost with lower capital costs.

MAINTENANCE AND MATERIAL SUPPLIES

As with capital equipment small size will mean greater availability of spares and lower costs due to competition in equipment supplies. A large market for equipment will attract specialist replacement parts suppliers as well as off the shelf rebuilt items. On the other hand, large users can negotiate discounts for supplies such as fuel, oils and other consumables.

OVERHEADS

Management has to decide on the level of overheads appropriate for the sales volume and future growth of the company. Small companies can use part-time workers or agents for secretarial, accountancy, insurance and shipping services. They can use consultants for marketing, mine planning and engineering studies. Large organisations tend to try and do everything in-house but still use consultants for a second opinion. Decisions on office space and location are often made for reasons of corporate image rather than utility. Thus small companies will often have lower overheads than large companies.

CHARBON

An example of a small mine is Charbon which was expanded for export in 1986. The Charbon deposit is an outlier in a northern part of the western NSW coalfields. The full section of the Illawarra Coal measures about 120m which is exposed along a north-south ridge and capped by a prominent peak of sandstone. The outlier covering the lease and authorisation area to the south is 1.2 - 1.5km wide and about 8km long. The uppermost seam, the Katoomba, is only developed over small portions of the lease high on the ridge and is of poor quality. The Irondale or Wolgan seams 80-90m below the Katoomba consists of two narrow plies of good coal totalling about 1.1m separated by a large section (1.8m) of inferior coal. This is uneconomic for underground working but could be recovered in some areas by open cut mining. The Lithgow seam 25m below the Irondale is mined underground by the bord and pillar method. Recoverable reserves in the lease and authorisation areas are about 20MT. Open cut potential exists in areas of low cover and add at least 6MT of additional reserves.

In early 1984 it was indicated by Japanese agents that there was interest in a low ash product from the Lithgow seam for blending with coking coal and PCI (pulverised coal injection). A review was made of past washability tests which showed a good yield (80%) of 9.5 ash product. In mid 1984 a bulk sample was sent to ACIRL and Sedgeman & Associates were asked to prepare budget estimates for a washery. At the end of 1984 the data had been gathered and concepts thought out for market presentations in Japan and other countries. BCSC Collieries obtained a letter of intent from a large customer, a letter of interest from another customer plus interest from many other customers. Engineering and feasibility studies were commenced in early 1985. By May 1985 the board gave approval in principle so an EIS could be prepared. Consultants GHD managed to issue the EIS in six weeks and it went on display mid-June 1985. When it was clear there were no objections BCSC group engineering prepared specifications and went out to tender.

The AusIMM Illawarra Branch, 21st Century Higher Production Coal Mining Systems—Their Implications, Wollongong, NSW, April 1988
By November 1985 tenders had been assessed, the Minister of Environment and Planning had given consent and the BCSC board gave final capital expenditure approval, so orders could be placed. In early December, 1985 the first contractor, White Industries, was on site. The first washed shipment was loaded in early July, 1986.

This fast track project using consultants was only possible because of rapid decision making and a small capital cost in absolute terms. The mine was expanded from about 180,000tpa ROM coal sold unwashed to the domestic market to 600,000tpa ROM with a new washery and 400,000tpa export through a new rail loading facility for a capital expenditure of about $16 million.

Figure 3 gives a layout of the surface facilities. Figure 4 is a flow diagram of the coal preparation plant and Figure 5 is a perspective of the unique rail loading facilities. To highlight some of the decisions, taken the facilities will be explained in more detail.

BCSC Collieries was formed in 1976 to manage Blue Circle Southern Cement Ltd's three small collieries. Overheads were always kept low.

In 1984 management consisted of a General Manager, a Manager Coal Services, an Accountant and a Secretary and three Colliery Managers. It was, thus, necessary to use consultants during all stages of the project. This had the advantage of obtaining expert assistance within strict time and cost restraints.

It was decided to use as much as possible of existing equipment to minimise capital costs and to maintain continuity of deliveries to domestic customers during construction. One of the existing road bins thus became the washery feed bin. The location of the washery was dictated by the terrain and this decision.

Bringing the railway loop close to the washery meant that a cutting would be necessary which had to be bridged to provide access to the stockpile. Jim Wall, the then General Manager, conceived the idea of the unique loading system in a tunnel under the stockpile from his past work experience with iron ore in W.A. The idea was that up to two unit trains could be drawn directly from the stockpile. Coal would then be pushed into the loading bins by a bulldozer which at other times would be used on other tasks such as run of mine stockpile management, reject placement, etc.

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This loading facility, which was built by White Industries under design-construction contract with O&M-Planner "was responsible for conceptual design and site supervision, recently won the O&A Ritchie Memorial Trophy of the Australian Institute of Materials Handling."

The need for a consistent quality low ash coal as the major product required a dense medium cyclone washery. Pilot plant trials at ACEM indicated a good performance for spirals which could avoid excessive flotation for fines treatment.

Consultants' sub-contracts were asked to prepare conceptual designs on which tender specifications could be based. Blue Circle Southern Cement Ltd Group Engineering were used as consultants to issue specifications, assess tenders and supervise mechanical construction. The coal preparation plant tender for design and construction was won by Simeon Carves. The final plant after much negotiation incorporated series and parallel operating modes in a two-stage plant plus run-of-mine bypass to give maximum flexibility to meet market demands, yet costs were contained within budget.

Underground coal working, disposal of tailings in old mine workings, out of sight reject disposal in a valley or company owned land, make up water drawn from company owned resources and transport of export coal by rail were helpful factors in gaining rapid development approval.

Tenders for the coal preparation plant showed that central control with FOC's and computer monitor was cheaper than conventional electrics. The plant has sequence starting and shuts down, automatic level and density controls and TV monitors at potential blockage points. Facilities exist to automatically control product quality and in future to operate the washery remotely with no manned.

To avoid labour and capital costs for a laboratory, a coal seine was installed on the main product belt. While there have been calibration problems with absolute ash values the instrument has been of great value in maintaining product specification. The coal preparation plant is operated by the mine mechanics who are at the same time involved with maintenance.

THE FUTURE

CAPITAL EQUIPMENT

History in all industrial development has shown a progression to more capital intensive operation. In coal mining the industry has moved from pick-shovel labour intensive production to continuous miners and shearsers underground, and dragline and bucket excavators in open cut mines.

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Much will be discussed during this symposium on 21st Century Mining Systems about large scale equipment. The 21st century is not far away so it is likely that improvements and developments of present available technology will see us through to that time.

For a small scale mine the short wall using chocks, a continuous miner and a flexible conveyor train seems to be the next step to productivity increase. Alan Risbey, 1987 mentions a capital cost of 25-30% of a long wall and potential production rates of 2000t/shift with a face crew of six.

Considering BGC production rates with continuous miners of around 25t/man employed we believe such production rates which would double or triple our productivities, are attainable with regard to development one can envisage remotely operated road headers with flexible conveyor train using laser sensors and automated roof bolting equipment. This is already technically possible but just needs more development of robust and safe control equipment for coal mine environments.

In the longer term programmed robots will do most of the work at the face particularly that of a repetitive nature such as greasing and bolting.

For a small mine with limited skilled human resources high speed travel will be essential. Air cushion vehicles, already available, would overcome the problem of poor roads and standing water but they need to be able to rapidly negotiate corners. Mines need to be planned to make travelling roads as straight as possible so guidance and control systems can be used to obtain maximum speeds.

LABOUR

Multiskilling already exists to a small extent where mine mechanics operate plant, drive vehicles and repair equipment. Under Margaret Thatcher in the UK there has been a move to break down Union demarcations and introduce multiskilling. At Blue Circle Industries Cement (UK) plants, trained plant operators can effect minor repairs and electricians can operate plant, uncock motors and use lifting gear. At most plants the workforce has been reduced by 50% and at the same time plant performance with respect to production and quality has improved.

For a small mine multiskilling is one of the most important issues in remaining competitive. Single union coverage for all employees would be of great benefit. It would also be desirable for unions to be enterprise based.

Much attention will need to be paid to hiring skilled people and to on job training. The Joint Coal Board's heavy hand with respect to regulation and orders needs to be abandoned. For example, a mine which is wet and the only gas is traces of black damp should not be forced to adopt practices laid down for a gassy (methane rich) mine. The coal industry tribunal with all its award conditions must be scrapped. In place of these there is need for an industry financed and accountable training scheme with incentives such as insurance bonuses to ensure appropriate use by individual mines plus an intelligent and sympathetic inspectorate which would make reports on safety and training to insurance companies. The costs of work practices, work skills and management competence would then be reflected in the operating costs of the mine.

MAINTENANCE AND SUPPLIES

With a small workforce, equipment needs to be designed for simple maintenance. Smaller large volume selling equipment tends to have a greater industrial design input but equipment manufacturers need to be aware of need for minimum parts, easy access and rapid replacement.

OVERTHEADS

As with labour, management also has to be multiskilled in a small company. The best way to achieve this is to have a very flat organization and have a team approach to task achievement.

Production planning, budgets and investment decisions need to involve all staff at least in the initial stages of preparation. Involvement in decisions is the best means of communication. A small responsive team is in a better position to make decisions which may appear risky to a large organization but to make such decisions management must be aware of the financial consequences of their decisions. Risky decisions, which normally give a higher financial return, can be managed by having a contingency plan and acting swiftly if things go wrong.

Even with multiskills and multitasks, management in a small company will be stretched for time or will not have sufficient expertise. Consultants or temporary staff can be called on to assist. A busy person will not have a fear for his job when an outsider joins the team to lend a hand. The consultant will get maximum cooperation and do a better job.
SUMMARY

Along with mini-steel mills, mini oil refineries, boutique breweries, hot bread shops, etc, the small mine will survive to service particular market sectors. The small mines at the present time can be cost competitive with the correct management decisions. BCSC Collieries' Charbon mine is an example of a productive mine with low capital costs.

For a small mine the future lies in investing in more productive high speed automated equipment rather than larger scale. Labour and management need to become more multiskilled. To bring this about there must be changes to the present Coal Mines Regulations Acts and changes to the industrial climate. Cost incentives need to be put in place for job training and skill improvement. Open competition, no government interference, and no restrictive practices by anyone in the coal chain has more benefits for the small mine than the large.

REFERENCES