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Economic responses to the closure of small-scale coal mines in Chongqing, China

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Abstract

In 1998, China launched a programme to close tens of thousands of small-scale coal mines within just three years. Few measures were put in place to mitigate the negative impacts. This paper reports on a study in the Chongqing Municipality of south-west China, with the aims of identifying the economic impacts of the mine closure campaign and examining what factors permitted some localities to respond more successfully to the resulting economic challenges. Those areas with greater wealth and more diversified economies were able to absorb the shock of mine closure more effectively than poorer areas and those with less diversified economies. These latter groups either failed to respond to mine closure or reacted by increasing output from the remaining mines. In the successful cases, though the economy of the area as a whole was able to withstand the impact of the mine closure campaign, no evidence was found of any attempts to assist those in the local communities directly affected by mine closure.

Keywords: Small-scale mine; Coal; Mine closure; Economic impact; China

Introduction

The last ten years or so have seen increased international concern over a number of features of the mining industry, two of which are of particular relevance to this study. The first is the management of the socio-economic impact of large mines and the planning for the closure of these mines. The second is the effective regulation of small-scale mines. However, little attention has been devoted to the overlap of these two issues—that is managing the closure of small-scale mines so as to minimise the negative socio-economic impact.

For more than fifteen years, locally-owned coal mines provided a substantial share of China's total domestic coal production. They were known as township and village coal mines. Although the size of some of these mines exceeded most people's definition of a 'small-scale mine' (Hollaway, 1986; Kumar and Amaratunga, 1994; Burke, 1997), these operations suffered from many of the same problems as conventional small-scale mines: large numbers of illegal operations; irrational locations; low recovery rates; poor safety standards; and substantial environmental damage (Smil, 2000; Wright, 2000; Horii, 2001; Gunson and Yue, 2002).

During the period 1998–2002, the government of China ran a campaign to close tens of thousands of small-scale coal mines across the country. The closure programme was carried out in such haste that no plans to address the socio-economic impact could be drawn up in advance. Hundreds of thousands of people lost their jobs and many local governments saw an immediate decline in revenue. China therefore provides an opportunity to study how local governments have responded to a closure campaign driven by higher levels of government but with little support from these higher levels of government to mitigate the negative economic impacts.

This paper reports the results of a study in Chongqing Municipality in south-west China where many hundreds of mines were closed. Five areas were chosen for examination,

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selected to illustrate a range of pre-existing economic conditions. The aim of the study was to identify the economic responses in the different areas, and to examine the factors which determined the nature of these responses.

The paper first reviews current approaches to planning for the closure of large-scale mines and identifies a number of features which distinguish small-scale mines in the context of mine closure. This is followed by a brief description of the small-scale coal mining sector in China and of the campaign to close many of these mines. The remainder of the paper presents and evaluates five case studies from Chongqing, drawing published data and interviews relating to the period 1997–2001. The interviews were carried out between June 2002 and April 2003.

The surge in demand for coal in China from the year 2002 has led to record levels of domestic production involving both the expansion of existing small-scale mines and the re-opening of 'closed' mines. These impact of these events have not been examined in this study.

Planning for the socio-economic impact of mine closure

Managing the environmental impact of mining and the rehabilitation of mine land after the end of mining operations has been a major concern for governments and mining companies for more than twenty years. In many countries, mining companies are required to draw up rehabilitation plans before mining operations start and to put in place financial mechanisms to ensure that the reclamation will actually be implemented (Redgwell, 1992; Kuhne, 1992; Kahn et al., 2001). Special funding mechanisms have also been developed to clear up mine sites which have already been abandoned (Brook, 1994; Meyer et al., 1995). Such formalised and tightly regulated approaches are generally absent with respect to addressing the local social and economic impact of mine closure. Only in the last ten years has the significance of this policy vacuum be identified.

The closure of a mine will almost always have an immediate and significant negative economic impact on the local community, unless the mine has been operated in such a way as to minimise contact with the community. In simple terms, the negative economic impact takes the form of the removal of some or all of the positive contributions made by the mine during its life. These might include the following: employment in the mine, spin-off economic activity, local tax revenue, physical infrastructure and social services. The removal or deterioration of these economic components of life around the mine site will not only affect the economic strength of the community but substantial economic decline will almost certainly result in a range of social problems (Rocha and Bristow, 1997; Mining Minerals and Sustainable Development, 2002a). Common symptoms include unemployment, crumbling infrastructure, failing social services and rising crime.

It is widely agreed that mining operations should be designed in order to maximise the long-term benefit to the local community, and that the phrase 'long-term' includes the period after mine closure (Veiga et al., 2001; Mining Minerals and Sustainable Development, 2002b). This parallels the realisation that care must be taken at a national scale to improve the chances that mining provides a basis for sustainable economic development rather than just a short-term flow of cash which is dissipated (Mining Minerals and Sustainable Development, 2002a).

For these reasons, planning for mine closure needs to be an integral part of the planning for the whole life of the mine, and the socio-economic dimensions of mine closure are as important as the environmental ones (Clark and Clark, 1999; Mining Minerals and Sustainable Development, 2002c; Jackson, 2002). Such a long-term approach should address two features of mine closure. Firstly, by the time the mine is closed the mining company and the higher levels of government will necessarily have lost interest in the region. Secondly, if their economic outlook is reasonable, workers and communities are less likely to object to the closure of the mine (Mining Minerals and Sustainable Development, 2002a).

The last few years have seen a spate of publications which broadly converge around a set of common themes (Rocha and Bristow, 1997; Warhurst and Noronha, 1999; Roberts et al., 2000; Khanna, 2000; Veiga et al., 2001; World Bank, 2002; Mining Minerals and Sustainable Development, 2002a,b; Chilean Copper Commission, 2002; Laurence, 2002; Hoskin, 2004). Two important dimensions of these proposed approaches for planning for closure include which parties should be involved and what measures can be taken. The central government and the mining company are identified as key players: the first to put in place policies and regulations and to ensure implementation, and the second to provide some or all of the funding and to play an important role in implementation. Other parties which need to be involved from the earlier stages of planning onwards include employees, local people, local government, local businesses, land owners and, where, relevant, NGOs. Many of these parties are local to the mine and can be regarded as expressing the different concerns of the local community. So, aside from the NGOs, effective mine closure policy is seen to rely on a triangle of interests: central government, or at least a high level of government, the mining company and the local community. Of these, the mining company is arguable the most important. Large multinational mining corporations have international reputations to protect, and so are increasingly prepared to devote considerable resources to manage mine closure.

Concerning what should be done, there exists a wide range of ideas, different combinations of which may be used depending on the circumstance. Measures include: developing infrastructure which will last a long time; stimulating alternative economic activity during the mining operation in order to diversify the local economy; educating and training

employees and locals to develop new skills; and encouraging the continuation of local subsistence activities.

These are relatively new concepts for the mining industry and most countries have yet to put in place regulations, procedures and norms to address the socio-economic challenges posed by large-scale mines (Chilean Copper Commission, 2002).

The closure of small-scale mines

The literature on small-scale mines is almost entirely focused on managing the mining rather than the process of closure. A review of the recent literature revealed only a small number of publications which address the problem of closure when applied to small-scale mines. These publications take two forms. The first type of paper addresses mine closure in general and makes reference to one or more cases of small-scale mines, but without clearly identifying the specific problems of small-scale mines (for example: Laurence, 2002). The second type focuses of the regulation and management of small-scale mines in general and makes passing mention of the closure problem, but fails to address in any detailed way the management of mine closure (for example: Hollaway, 2000; Mining Minerals and Sustainable Development, 2002d). Those papers which do address the closure of small-scale mines tend to focus on land rehabilitation and allude to proposed schemes, pilot projects or wider frameworks which are weakly implemented (Hollaway, 1999; Ayree, 2003; Ghose, 2003; Macedo et al., 2003). The management of the socio-economic impacts of the closure of small-scale mines does not seem to be on the policy agenda.

The one exception to this policy gap is the concept of 'alternative livelihoods' which seeks to address the negative impacts of small-scale mining by drawing people away from mining into alternative employment (Labonne, 2003). Though this concept has some similarities with planning for mine closure, the drivers are somewhat different. The approach of 'alternative livelihoods' emphasises the desirability of constraining or reducing small-scale mining activity by providing other sources of earned income. The challenge addressed in this paper is that of planning for the negative socio-economic impact of mine closure, regardless of the reasons for that closure.

The favourable conditions which can allow for systematic planning for the closure of large-scale mines do not exist for small-scale mines. The small-scale mining sector is permeated by weak legal and regulatory regimes in which either the laws and regulations are inappropriate or the institutions are incapable of effective implementation. These weaknesses will apply to the closure process as much as to the management of operating mines. The relatively impoverished nature of some, but not all, mine owners and of the local governments which tax the mines, together with the weak regulatory regime, ensure that funds are rarely accumulated to address mine closure issues, either environmental or socio-economic.

The triangle of interested parties is quite different from that for the large-scale mines. The 'mine owners' in many cases will be local people, local companies or indeed the local government itself. The involvement of higher levels of government tends to be rather limited, and responsibility for regulation may fall to local government. Thus the triangle of interests is heavily distorted and focused on the 'local' corner. This has two consequences. First, there are no 'big' players with power and money who can provide political drive, guidance and funding. Second, the interests of higher and lower levels of government may be quite different. The higher levels may want to close the mines for environmental or other reasons. The local government may want to keep the mines open for economic reasons. Third, conflicts of interest amongst the local parties may prevent decisive action.

It might be argued that the closure of small-scale mines is a local problem which should be delegated to local government. But without active support, advice and encouragement from above, local government may lack the skills, the resources and the will to manage mine closure in a structured manner. Without a systematic policy framework devised by higher levels of government, how local government addresses the socio-economic impact of the closure of small-scale mines is likely to depend on a wide variety of local economic, political and social factors and the degree of success may be highly unpredictable.

The growth of township and village coal mines in China

China's production and consumption of coal was the largest in the world during the 1990s. Between 1995 and 1997 annual production lay in the range 1350–1400 million tonnes. Coal accounted for nearly 75% of primary energy production and consumption (Thomson, 1996; Sinton and Fridley, 2000). Some 45%, or more than 650 million tonnes, of this production came from 75,000 to 80,000 so-called township and village coal mines (hereafter referred to as 'TVCMs'), a large proportion of which were owned and controlled by local governments at the township and village level. A substantial minority of these mines, usually the smaller ones, were privately-owned. Some others were owned by a variety of state companies and agencies, including the army and prison service. The average output of these coal mines varied from as much as 25,000 tonnes per year in major coal mining provinces, to as little as 4000 tonnes per year in provinces with fewer operations. The largest township mines had a capacity in excess of 100,000 tonnes per year. At the other end of the spectrum lay thousands of artisanal mines with outputs of a few hundred tonnes per year.

The TVCMs were overtly encouraged by all levels of government from the early 1980s when China faced a crisis

of energy supply (Wright, 2000). Laws and regulations, such as they were, were ignored by government agencies and flouted by miners in the interest of economic growth and profit, respectively. Even new laws and regulations drafted in the 1980s and 1990s to cover safety, environmental protection and licensing were not implemented widely in the small-scale coal mining sector until the late 1990s (Andrews-Speed et al., 2003).

In addition to providing much-needed energy, the small-scale coal mines provided a basis for local employment and development in many poor and remote areas of China. Possibly as many as four million people were employed in the sector at the time of peak production. This was symptomatic of a much wider transformation of the rural economy. From the late 1970s to the mid-1990s the proportion of China's population involved in agriculture fell from 70 to 50%. But a large proportion of these 200 million or so found work in the booming township and village enterprises and in service industries (Cook and Maurer-Fazio, 1999). Other benefits from the growth and geographical spread of the TVCMs included the following (Andrews-Speed, 2004).

- The exploitation of small, complex, remnant or otherwise economically-marginal coal deposits which were of no interest to the state-owned mining companies.
- A diminished need for coal transportation, as coal was now exploited closer to the centres of demand.
- The substitution of coal for firewood reduced the destruction of forests in areas where coal had not been available previously.
- TVCMs provided economic competition to the larger state-owned coal mines.

From the early 1980s to the mid-1990s, the central government's attitude towards TVCMs may be characterised as encouraging, yet ineffective. Production grew at a prodigious rate but legal, technical, environmental, and safety requirements seemed to be ignored in most mining areas. Short-lived and half-hearted rectification campaigns failed to make any significant impact on the behaviour of miners or local governments. As a result some 30% or more of the TVCMs were illegal in the sense that they lacked the full suite of necessary approvals and licenses. However, many of these mines might have been considered 'legitimate' because they received tacit or substantive support from one or more government agencies, and operated in a regulatory twilight zone.

Such a failure to adequately regulate small—scale mines is typical of many developing and transition economies. In the case of China, the failure to adequately regulate the TVCMs can be traced to two main causes (Andrews-Speed et al., 2003). The first was the excessive load of laws and regulations which accrued in an ad hoc manner during the 1980s and 1990s. Legal instruments governing mineral resources, land management, environmental protection and coal mining operations were developed and promoted by institutions with quite different agendas, with little or no coordination. The result was duplication and inconsistency. Second, the multi-layered and multi-stranded nature of China's government rendered effective implementation of national policy at township and village level very difficult if the lower levels of government were determined to resist. Rivalry and overlapping responsibilities between government agencies further diluted the impact of central government policies and complicated the task of the mine owner.

From late 1997 to 1998, there was a sudden drop in demand for energy in China, and the coal industry was affected more than other energy industries. This fall in demand for energy—especially for coal—is best explained by a general economic slowdown resulting from the Asian crisis, a decline in output from energy-intensive industries, closures of inefficient state factories and a general increase in end-use efficiency, as well as some substitution for coal by gas (Sinton and Fridley, 2000). Stockpiles of coal grew to hundreds of millions of tonnes and prices in the domestic market plummeted (Sinton and Fridley, 2000; Wright, 2000). In early 1998, production from some state-owned mines was suspended for two months in order to ease the oversupply problem. By the middle of the year, it became clear that this was not a temporary phenomenon; drastic action was needed to protect the interests of state-owned mines into which large amounts of state investment had been poured.

The closure campaign at national level

In the autumn of 1998, a plan was announced by the central government to close some 25,800 illegal and 'irrational' mines (mainly TVCMs) by the middle of 2000 in order to reduce output by 250 million tonnes per year. It was reported that 33,000 mines had been closed by the end of 1999, reducing annual output by 300 million tonnes. By late 2001 the total number of TVCMs had reportedly been reduced to 23,000, resulting in a reduction in annual production from 620 million tonnes in 1997 to 200 million tonnes. As well as TVCMs, a number of larger mines (near exhaustion) have been closed and some enterprises made bankrupt.

Official documents clearly identified and categorised the TVCMs targeted for closure. These included the following.

(a) Mines with neither mining nor production licenses.
(b) Mines opened within the areas of state-owned mines since 1st January 1997, which, by law, could not have been granted a mining license.
(c) Mines opened within the areas of state-owned mines before 1st January 1997 which had mining licenses but which lacked production licenses.

(d) Mines opened within the areas of state-owned mines before 1st January 1997 which had mining and production licenses, but which had a negative impact on the state-owned mine.
(e) Mines exploiting coal with high sulphur and ash content, and without appropriate countermeasures;
(f) Mines operating outside the areas of state-owned mines, which had mining licenses but no production licenses.

Compensation was to be paid only to those mines in category (d), as they were the only formally legalised mines on the list (Zhang, 1999). Mines in category (f) were given the opportunity to raise their technical and safety standards and apply for a production license before the end of February 1999. The smaller mines in this category were encouraged to merge with other mines to provide the financial and technical benefits of scale (Wang, 2000).

The level of local government responsible for the implementation of the closure campaign was the county. These county governments faced a conflict of interests. On the one hand, closure of some TVCMs provided protection for county-owned state mines; on the other hand, TVCMs provided an important source of employment and revenue from taxes and fees. As a result, it is likely that the actual extent of mine closure and production abatement was significantly less than that reported. Official figures show a sharp divergence from 1998 between rapidly declining coal production and only modestly declining coal consumption (Sinton and Fridley, 2000). The magnitude of this divergence suggests that coal supplies were drawn from unreported coal production, presumably from TVCMs, as well as from the large stockpiles (Sinton, 2001).

At least three parties suffer economic loss when a small-scale coal mine is closed. The owner of the mine loses their investment and future cash-flow. The local government loses tax revenue, in addition to any losses it sustains as partial or whole owner of the mine. Finally, the workers lose their livelihood, whether they be local people or migrants.

The challenge is greatest for those local governments which lose revenue from these mines and find themselves with an enhanced level of unemployment. Although the official line might have been that the redundant workers should be redeployed to other township and village enterprises, in most areas this would have been unrealistic as the local enterprise sector as a whole was going through difficult times as a result of both market competition and the administrative closure of small, polluting enterprises in other sectors.

Migrant underemployed rural workers formed major part of the TVCM labour force in some provinces, and hundreds of thousands will have lost their jobs if the number of TVCMs closed was indeed as high as has been reported. The general view of government officials in coal mining areas appears to have been that these people are not their responsibility and that they should return to their villages.

The available evidence suggests that the potential negative socio-economic impact of the TVCM closure campaign did not feature highly in the list of priorities for the higher levels of government and that few or no systematic support or mechanisms were put in place to deal with the inevitable impact on communities (Shi, 1999). Indeed it was the lack of attention to these issues which led to the formidable and sustained resistance to the closure policy by local governments and communities.

The closure of the TVCMs was taking place against a background of rising rural unemployment and migration to the cities. From the mid-1990s the rate of growth of rural employment in non-agricultural activities declined sharply. From 1996 to 2002, China's total rural population declined whilst total urban population rose by some 130 million.[1] This reflected both movement from the countryside to the cities as well as the progressive urbanisation of the countryside. Further, these figures do not include the floating population of about 100 million peasants who work in the cities but are officially rural residents (Wang, 2004).

Official figures indicate that coal output from TVCMs fell from 570 million tonnes in 1997 to a low of about 250 million tonnes in 2001 (Andrews-Speed, 2004). It then doubled to more than 500 million tonnes in 2003,[2] equivalent to the reported TVCM output in 1998, in the early stages of the closure campaign. Over the period 2000–2003 official statistics state that the total national output of coal increased from about 1000 to 1600 million tonnes. This growth in total coal production was due to the soaring domestic demand for energy as the economy grew at a rate of about 10% per year, with heavy industry playing a major role in this growth. In order to meet this demand, output from remaining TVCMs was raised and 'closed' TVCMs were re-opened.

The closure campaign in Chongqing Municipality

Chongqing used to be the largest city in Sichuan Province in south-west China. It was elevated to Municipality status, equivalent to that of a Province, in 1997.[3] The population of Chongqing Municipality in the year 2000 was thirty million. At that time, the annual per capita GDP of RMB 5160 Yuan compared with a national average of RMB 7080 Yuan.[4] In the past the economy of Chongqing relied on heavy industry as the city lay at the heart of one of Mao

[1] National Bureau of Statistics, China Statistical Yearbook 2003 (Beijing: China Statistics Press, 2003).
[2] Interfax Energy Report Weekly, 3–9th January 2004, vol. III, Issue 2, p. 10.
[3] Officially China is a unitary state, but substantial political and economic powers are delegated to different levels of government. In simplified form, these are (in descending order): Province, Prefecture or City, County, Township.
[4] National Bureau of Statistics of China, supra note 14.

Zedong's strategic industrial areas, located well away from the coast and from Russia to the north. Structural reforms to China's state industries have hit the municipality hard and a large number of factories lie idle.

Coal dominates the energy sector in Chongqing, accounting for some 80–85% of primary energy production and consumption. The other main indigenous sources of primary energy within Chongqing are natural gas and hydro-electricity. The province is a modest net exporter of coal and natural gas and an importer of electricity.[5]

Township and village coal mines have traditionally produced about fifty percent of Chongqing's coal output. In 1997 and early 1998, some 4500 TVCMs were active and producing about 15 million tonnes of coal per year, out of a total of about 28 million tonnes for the province.[6] Thereafter, information for coal output diverges greatly. On the one hand the Chongqing Statistical Yearbook[7] and the national Energy Statistics Yearbook[8] report a total output steady at 28–30 million tonnes. On the other hand the Coal Industry Yearbook[9] records a reduction to about 20 million tonnes in 1998 and 1999, and provides no data for 2000. The Chongqing Yearbook[10] documents a reduction of 11 million tonnes over two years to an annual output of 16 million tonnes in 2000. Unpublished data from the Chongqing Coal Bureau show a total of 1233 TVCMs active in 2001 with an annual output of 9.7 million tonnes and a total annual capacity of 22 million tonnes. Output from the TVCMs may have been as low as 6.5 million tonnes in 2000.[11]

These figures reflect a vigorous and successful implementation of the TVCM closure campaign. If they are to be believed, a total of some 3300 TVCMs were closed during the period 1998–2000. The initial closure resulted in a reduction of output from these mines from 15 million tonnes to possibly less than 7 million tonnes per year with a subsequent rise to nearly 10 million tonnes by 2001. It is understood that this subsequent increase in TVCM production has been the result of officially-sanctioned upgrading and expansion of some of the remaining TVCMs. This has been accompanied by a transfer of ownership of many mines from the township or the village collective to private hands. Such privatisation of township and village enterprises has being taking place throughout China, and few now remain as collectives (Li and Rozelle, 2003; Green, in press).

Approach to the case studies

Five case studies were examined in Chongqing Municipality. Four of these were counties and one was a township (Table 1). The cases were chosen in order to draw on a range of economic conditions, for example with respect to overall wealth and dependence on coal mining. At each location structured interviews were held both in the government offices and in one active mine. These visits were preceded by interviews of officials in the municipal government of Chongqing.

The information presented here draws on official publications as well as on the structured interviews. Quantitative economic and social data at county level is drawn from the Chongqing Statistical Yearbook for different years. Quantitative and qualitative information concerning the coal mining and the impact of and responses to the mine closure campaign is taken from the interviews with officials from county governments and managers of mines. The published data has the advantage of completeness and a relatively high degree of internal consistency, though allowances have to be made for distortions and inaccuracies. The interviews were vital for gaining insights into the central questions addressed by the study, but is lacking in formality and consistency of approach. For these reasons, it is necessary to treat all the numerical data presented here with a certain degree of caution and attention should be focused on gross trends and major differences.

As the objective of the study was to examine the impacts of and the responses to the mine closure campaign, the information has been gathered to illustrate the economic circumstances 'before' and 'after' the campaign. Data from

Table 1
Basic data on case studies

County	Township	Distance from Chongqing city (km)	Direction from Chongqing city	Mine
Yubei		20	North-east	Longxing
Bebei	Tianfu	30	North	Maliu
Tongliang		50	North-west	Yonghong
Yongchuan		50	South-west	Shuangshi
Rongchang		80	West	Hongqiao

[5] National Bureau of Statistics of China, China Energy Statistical Yearbook 1997–1999 (Beijing: China Statistics Press, 2001). National Bureau of Statistics of China, Chongqing Statistical Yearbook 2001 (Beijing: China Statistics Press, 2001, in Chinese).

[6] Administration of State Coal Industry, China Coal Industry Yearbook 1998 (Beijing: China Coal Industry Publishing House, 1998). Chongqing Municipal Government, Chongqing Yearbook 1999 (Chongqing: Chongqing Yearbook Publishing House, 1999, in Chinese).

[7] National Bureau of Statistics of China, Chongqing Statistical Yearbooks 1999, 2000, 2001 (Beijing: China Statistics Press, 1999, 2000, 2001, in Chinese).

[8] National Bureau of Statistics of China, China Energy Statistical Yearbook 1997–1999 (Beijing: China Statistics Press, 2001).

[9] Administration of State Coal Industry, China Coal Industry Yearbook 1999 (Beijing: China Coal Industry Publishing House, 1999). Administration of State Coal Industry, China Coal Industry Yearbook 2000 (Beijing: China Coal Industry Publishing House, 2000). Administration of State Work Safety, China Coal Industry Yearbook 2001 (Beijing: China Coal Industry Publishing House, 2001).

[10] Chongqing Municipal Government, Chongqing Yearbook 2000 (Chongqing: Chongqing Yearbook Publishing House, 2000, in Chinese). Chongqing Municipal Government, Chongqing Yearbook 2001 (Chongqing: Chongqing Yearbook Publishing House, 2001, in Chinese).

[11] Chongqing Municipal Government, Chongqing Yearbook 2001 (Chongqing: Chongqing Yearbook Publishing House, 2001, in Chinese).

the statistical yearbooks has been presented for the years 1997, 1999 and 2001 which span the closure campaign. The interviews took a less formal approach and distinguished just 'before' and 'after'.

Settings of the case studies

The five case studies lie within 100 km of Chongqing city, to the north and west. They were chosen to represent a variety of geographical and economic settings.

Yubei county lies adjacent to and northeast of Chongqing city. It comprises both a flat area between the Jialin and Yangtze rivers and some mountainous parts. Being so close to Chongqing city Yubei has many economic advantages including a large airport and a major new commercial and residential zone. The main manufacturing outputs are fertiliser, motorcycle parts and electrical cables and the main mineral resources produced are natural gas, coal and iron ore.

Beibei county is located to the north of Chongqing city in a mountainous and forested region. The county acts as a major transportation hub linking Chongqing with northern Sichuan on account of that fact that it is crossed by the Jialin river, a major railway line and key roads. Agriculture, horticulture and tourism are major economic activities, and a high priority is placed on environmental protection. Tianfu township, the location of the case study within Beibei county, lies some 30 km north of Chongqing city in a mountainous area and has a population of 47,000. Coal mining has provided and important source of wealth since late Ming Dynasty times (Seventeenth Century). Quarrying for construction materials is the other main industry. The agricultural land is of poor quality.

Tongliang is a heavily agricultural county in hilly land some 50 km to the north-west of Chongqing city. Silk garments and processed food are important secondary products from agriculture. A diverse range of mineral resources includes coal, celestite and construction materials. Indeed it has the largest open celestite mine in China. These mineral resources provide the basis for metallurgical and machine-making industries.

Yongchuan county lies immediately to the south of Tongliang, 50 km south-west of Chongqing city. The land slopes from the mountains in the north down to the Yangtze River in the south. Yongchuan is one of China's major coal-producing counties and also has significant production of natural gas, construction materials and gallium. Food processing, light engineering and the manufacture of motor cycle parts are also important industries.

Rongchang county is the most remote of the five case studies and is the furthest west of all of Chongqing's counties, some 80 km west of Chongqing city lying in low hills. As in Tongliang and Yongchuan, agriculture and minerals provide the basis for Rongchang's economy with coal, natural gas, gallium and construction materials.

Economic and employment statistics for the case studies, 1997–2001

Beibei county was the richest of the five counties in terms of per capita GDP (Table 2). In 1997, the other four counties were significantly less wealthy than Beibei. By 2001 three of these counties (Yubei, Tongliang and Yongchuan) had

Table 2
Gross domestic product (GDP) and local financial revenue to local government (LFR) for the case study areas

City	Year	GDP 1000 RMB	GDP/hd RMB	LFR 1000 RMB	LFR/hd
Yubei	1997	3,190,630	4059	130,210	166
	1999	3,897,110	4902	195,910	246
	2001	4,864,300	6020	359,800	445
	Growth	152%		276%	
Beibei	1997	5,070,580	8087	117,700	188
	1999	4,961,610	7801	141,130	222
	2001	5,763,400	9062	202,460	318
	Growth	114%		172%	
Tongliang	1997	3,003,730	3713	82,490	102
	1999	3,601,590	4474	113,850	141
	2001	4,477,590	5528	154,950	191
	Growth	149%		188%	
Yongchuan	1997	3,890,420	3796	102,620	100
	1999	5,147,750	4978	143,010	138
	2001	6,297,880	5998	190,750	182
	Growth	162%		186%	
Rongchang	1997	2,828,790	3554	96,290	121
	1999	2,968,480	3711	113,850	142
	2001	3,370,430	4176	110,480	137
	Growth	119%		115%	

Source: Chongqing statistical yearbook, 1998, 2000, 2002.

Table 3
Population and employment statistics for case study areas

City	Year	Total population (1000s)	Non-agricultural Population		Employment		Population density per sq km
			1000s	Percentage of total population	1000s	Percentage of total population	
Yubei	1997	786	144	18.3	471	59.9	541
	1999	795	171	21.5	491	61.8	548
	2001	808	196	24.3	473	58.5	556
Beibei	1997	627	234	37.3	340	54.2	830
	1999	636	243	38.2	314	49.4	842
	2001	636	266	41.8	327	51.4	842
Tongliang	1997	809	86	10.6	522	64.5	603
	1999	805	94	11.7	465	57.8	600
	2001	810	110	13.6	467	57.7	604
Yongchuan	1997	1025	179	17.5	548	53.5	650
	1999	1034	194	18.8	484	46.8	656
	2001	1050	228	21.7	472	45.0	666
Rongchang	1997	796	135	17.0	528	66.3	738
	1999	800	142	17.8	419	52.4	741
	2001	807	146	18.1	378	46.8	748

Source: Chongqing statistical yearbook, 1998, 2000, 2002.

experienced substantial growth and had drawn away from Rongchang which by then was the poorest of these counties. This is seen in the growth of both GDP and local budgetary financial revenue. Beibei was also distinguished by having the lowest proportion of non-agricultural population and the highest population density, reflecting the relatively high degree of urbanisation.

Despite the greater wealth, the level of employment was lower in Beibei than in all the other counties except Yongchuan. This is probably symptomatic of the progressive failure of many large state-owned enterprises in urban areas across China, especially in the old industrial heartlands like Chongqing. Employment rates were broadly static from 1997 to 2001 in Beibei and Yubei, fell by about 8% in Tongliang and Yongchuan, and plunged by 20% in Rongchang (Table 3).

The role of agriculture can be deduced from two statistics: the proportion of agricultural population and the contribution of agriculture to GDP. In terms of population Beibei was the most urban and Tongliang the most rural. In four of the study areas the proportion of non-agricultural population rose from 1997 to 2001, the exception being Rongchang. The data on the contribution of industry and agriculture to GDP show the prominent role of industry in Beibei, but identify Rongchang as being the most dependent on agriculture (Table 4).

On the basis of this information two of the five counties appear to be distinct from the other three: Beibei on account of its wealth and high degree of urbanisation, and Rongchang on account of its relative poverty and its high reliance of agriculture. No reliable statistical economic information was available for Tianfu township in Beibei county, but our observations on the ground indicated that Tianfu was significantly poorer than much of the rest of Beibei county.

These trends within and differences between the case study areas can be set against the employment statistics from the whole of Chongqing Municipality (Table 5). Over the period 1996–2001 the official population of the municipality grew by some 750,000. All of this growth was in the cities and total employment rose so that around 75% of the urban residents were employed throughout this period. Meanwhile the rural population remained unchanged, as did rural employment. However, employment in agriculture declined steadily whilst employment in mining and quarrying fell by more than 50%. These figures

Table 4
Contributions to GDP by industry and agriculture in 2001 for case study areas

	GDP Y RMB	Industrial		Agriculture	
		Y RMB	Share (%)	Y RMB	Share (%)
Yubei	4,864,300	1,359,240	28	930,520	19
Beibei	5,763,400	2,509,190	44	405,330	7
Tongliang	4,477,590	1,081,920	24	989,360	22
Yongchuan	6,297,880	1,572,670	25	1,350,630	21
Rongchang	3,370,430	899,700	27	977,880	29

Source: Chongqing statistical yearbook, 2002.

Table 5
Employment statistics from Chongqing Municipality, 1996–2001

	1996	1997	1998	1999	2000	2001
Total population	30.23	30.43	30.59	30.72	30.91	30.98
Total urban population	5.77	5.94	6.14	6.35	6.61	6.89
Total urban employment	4.24	4.42	4.57	4.73	4.96	5.25
Total rural population	24.56	24.52	24.45	24.42	24.20	24.38
Total rural employment	13.3	13.2	13.2	13.4	13.5	13.4
Rural employment in agriculture	9.91	9.62	9.43	9.55	9.21	8.84
Employment in mining and quarrying (urban and rural)	3.47	3.00	2.64	2.03	1.53	1.58
Rural labour force transferred to other provinces	1.30	1.50	1.37	1.33	n/a	n/a
Rural labour force leaving, million	1.17	1.13	1.26	1.64	n/a	n/a

Source: Chongqing statistical yearbook, 1998, 2000, 2002.

hide the fact that nearly three million people were leaving the municipality each year either 'transferred' or leaving of their own accord.

The mines before the closure campaign in the case studies

All five cases have long histories of coal mining reaching back to one hundred years or more, and to as many as three hundred years in Tianfu. The mines are all underground. Focusing only on the data relating to the time before the mine closure campaign it is evident that Rongchang, Yongchuan and Yubei were counties which produced substantial quantities of coal from TVCMs, whereas the output of Tongliang was relatively small (Table 6). Though the production in Tianfu is smaller than the others, this is relatively large in proportion to its total population. The average annual output of the mines varied from as high as 19,400 tonnes in Rongchang to as low as 2600 tonnes in Tongliang.

In three of these counties TVCMs account for all coal production: Yongchuan, Rongchang and Tongliang. In Yubei county some 25% of coal output came from mines owned by the state and in Beibei county this figure is 15%.

The nature of the destination of the coal output varies considerably between the five cases (Table 7). Tongliang county consumes most of the coal it produces which is unsurprising given the low level of coal output. In contrast most of the coal produced in Yubei county is exported because the county has strict clean air regulations. The large proportion of coal exported from Tianfu township reflects the large scale of the production of coal relative to the small population. Industry is an important consumer of coal, both for that consumed within the area of production and for that coal exported to other counties in Chongqing municipality and other parts of China.

The TVCMs were major sources of employment in Rongchang and Yongchuan, which is to be expected from the high outputs of coal, but they provided a relatively low amount of employment in Yubei on account of the relatively high productivity of the workforce (Table 8). The extremely low productivity of the mines Tongliang is probably a consequence of their small scale. In all regions studied, the mine work force comes predominantly (80–100%) from within the respective county and is employed on a full-time basis.

Information on the relative economic importance of the TVCMs to the local area is incomplete and probably not very reliable. Despite these drawbacks, the available data suggests that these mines made significant contributions to the local economy in Tianfu and Yongchuan. Both areas have a relatively high output of coal for their population and both export a large proportion of their production. Coal's contribution has been only modest in Rongchang and relatively insignificant in Tongliang and Yubei (Table 9).

Impacts of the closure campaign on mines in the case studies

In simple terms, possible responses by local government to the TVCM closure campaign may be characterised into four categories.

1. To comply with the mine closure campaign and successfully develop alternative economic activity.
2. To comply with the mine closure campaign and fail to develop alternative economic activity.
3. To comply with the mine closure campaign but raise output in the remaining mines.
4. To fail to comply with the mine closure campaign and allow mines to continue in operation.

If the data is to be believed, the local government agencies carried out an effective closure campaign by halving the number of TVCMs in operation across all five case areas, with a low of 30% reduction in Rongchang (Table 6a). However the total output has declined by only 27% (Table 6c). Output has remained unchanged in

Table 6
Statistics on the township and village coal mines in the five case study areas before and after the mine closure campaign

(a) Number of mines

Area	Before	After	Change	
Yubei	93	36	−57	−61%
Tianfu	32	18	−14	−44%
Yongchuan	210	126	−84	−40%
Tongliang	155	60	−95	−61%
Rongchang	67	47	−20	−30%
Total	557	287	−270	−48%

(b) Total mine capacity in thousands of tonnes

Area	Before	After	Change	
Yubei	1000	700	−300	−30%
Tianfu	200	200	0	0%
Yongchuan	2,000	1,640	−360	−18%
Tongliang	650	680	30	5%
Rongchang	850	1680	830	98%

(c) Total mine output in thousands of tonnes

Area	Before	After	Change	
Yubei	1000	500	−500	−50%
Tianfu	200	100	−100	−50%
Yongchuan	2000	1400	−600	−30%
Tongliang	400	250	−150	−38%
Rongchang	1300	1300	0	0%
Total	4900	3550	−1350	−27%

(d) Average mine output in tonnes

Area	Before	After	Change	
Yubei	10,750	13,890	3,140	29%
Tianfu	6,250	5,560	−690	−11%
Yongchuan	9,520	11,110	1,590	17%
Tongliang	2,600	4,200	1,600	61%
Rongchang	19,400	27,660	8,260	43%

Source: project interviews.

Rongchang. Indeed the official production capacity has been enhanced here (Table 6b). In the other four areas output has been reduced by between 30 and 50%. With the exception of Tianfu, the average annual output of the mines has increased substantially (Table 6d). This reflects a deliberate policy to encourage investment in the larger TVCMs in order to increase the degree of mechanisation, enhance safety conditions and improve profitability. In three of the cases studied a marked rise in productivity can be seen (Table 8b).

Although the Chongqing Municipal government reduced coal production quotas for the county governments, it appears that counties were allowed to exceed these quotas by a certain amount, provided the mines were in a safe condition and provided there was demand to be met. The driving force behind this policy flexibility seems to have been the large demand for coal from within the Chongqing municipality and the unwillingness to seek supplies from outside.

Table 7
Summary of patterns of consumption of coal produced by TVCMs after mine closure campaign

	Yubei	Tianfu	Yongchuan	Tongliang	Rongchang
Percentage of coal production used locally	10%	20%	26%	90%	40%
Local coal use, household: industry	60%:35%	40%:60%	20%:80%	10%:90%	40%:40%
Major coal user within area		Chemical plants	Power station	Power station	
Coal use outside area	Industry 90%	Industry 80%	Industry 99%	Industry	Industry
Major coal user outside area			Coke factories in Anhui and Shanghai	Xuning thermoelectric factory	Steel plants, power stations, chemical plants

Source: project interviews.

Table 8
Employment and productivity in township and village coal mines in the five case study areas before and after the mine closure campaign

(a) Total employment

Area	Before	After	Change	
Yubei	4500	2000	−2500	−56%
Tianfu	1200	750	−450	−38%
Yongchuan	20,000	12,000	−8000	−40%
Tongliang	3250	3000	−250	−8%
Rongchang	13,000	9800	−3200	−25%
Total	41,950	27,550	−14400	−34%

(b) Average productivity in tonnes of annual output per employee

Area	Before	After	Change	
Yubei	222	250	28	13%
Tianfu	167	133	−33	−20%
Yongchuan	100	117	17	17%
Tongliang	12	8	−4	−32%
Rongchang	100	133	33	33%

Source: project interviews.

The closure programme was accompanied by a wholesale transformation of the ownership structures of the TVCMs. The traditional TVCM was just one of many types of township and village enterprise, which was collectively owned by the people of the township or village, and would normally have been managed by a person appointed by the township government. In the cases studied, almost all the TVCMs were transformed to private ownership during the closure campaign. The resulting mine owners were either private individuals or

Table 9
Financial statistics from the five case study areas before and after the mine closure campaign

(a) Annual enterprise revenue from coal sales, million Yuan

Area	Before	After	Change	
Yubei	60	50	−10	−17%
Tianfu	20	10	−10	−50%
Yongchuan	1400	1500	100	7%
Tongliang	20.4	12	−8.4	−41%
Rongchang	75	150	75	100%

(b) Enterprise revenue from coal sales as a percentage of total enterprise revenue

Area	Before	After (%)
Yubei	n.a	0.8
Tianfu	25.0%	10.0
Yongchuan	43.8%	34.1
Tongliang	n.a.	0.3
Rongchang	3.5%	5.4

(c) Annual local government revenue from coal sales, million Yuan

Area	Before	After	Change
	Yubei	n.a.	3
n.a.	Tianfu	0.28	0.14
−0.14	Yongchuan	n.a.	20
n.a.	Tongliang	n.a.	14.4
n.a.	Rongchang	11.5	22.5

(d) Local government revenue from coal mining as a percentage of total local government revenue

Area	Before	After (%)
Yubei	n.a.	0.8
Tianfu	25.0%	10.0
Yongchuan	43.8%	34.1
Tongliang	n.a.	0.3
Rongchang	3.5%	5.4

Source: project interviews.

joint-stock enterprises comprising a number of individuals and enterprises.

The new owners were required to purchase the mine from the collective at a price determined by the local government. There were no public sales or auctions. In most cases, the new owners had already been involved in mining either as mine managers or as government officials. Though these sales were not illegal, for the local government had the authority to sell the mines, it is likely that prices were favourable to the buyers and that the collectives took a financial loss—though we have no data to support this contention. In most cases the new owners had to borrow money from friends and relatives in order to raise the funds for the purchase. The banks did not provide loans except for the largest mines.

The reduction of coal output both within Chongqing Municipality and across China resulted in the wholesale price of coal within Chongqing rising by some 30%. For this reason the sales revenues of coal mining enterprises appear to have risen in Rongchang and Yongchuan despite the reduction in output in the latter county (Table 9a), though the reliability of these figures is probably poor. Rongchang also saw a rise in the level of government revenue from coal mining enterprises (Table 9c).

Along with higher prices, those workers who were able to keep their jobs in the mines saw their wages increase. In the mines we visited, average monthly wages had risen from RMB Y 300–600 to RMB Y 400–800 since the closure campaign, and the maximum wage had risen from RMB Y 500–1000 to RMB Y 1000–2000.

In summary, though large numbers of mines have been closed, those mines which remain have experienced significant positive changes. Ownership has moved into private hands, investment has been made in production and safety, and sales prices have risen giving a boost to profits, wages and, in some cases, local government revenue.

Negative impacts of the closure campaign in the case studies

Despite the benefits reaped by the surviving coal mines, a number of parties suffered negative impacts from the closure campaign: mine owners, mine workers, local farmers, local enterprises and local government.

The owners of mines which had been closed experienced three simultaneous repercussions. They lost their income, they received no compensation and they were saddled with outstanding debts. As mentioned above, the national regulations only obliged local government to pay compensation to one category of TVCM: those opened legally within the area licenses to a state-owned mine. By not paying compensation to the mine owners the county governments in Chongqing were not flouting national policy, but that would have been of no comfort to the affected mine owners, be they collective or private.

Some 14,400 mine workers lost their jobs in the study areas, one-third of the TVCM workforce. Only Tongliang seems to have escaped major job losses, despite the reduction of total output (Table 8a). These employment figures are aggregated and so do not reveal the number of mine workers who lost their jobs in a mine which was closed but gained new employment in a mine which was being expanded. Just as the mine owners received no compensation from the government for the enforced closure of a mine, so the mine workers received no compensation from the mine owner for the loss of employment. Job losses in the mining and quarrying industries were taking place on a similar scale throughout Chongqing Municipality (Table 5), indeed across the whole of China.

The impact on local farmers was more variable and more difficult to assess. Those farmers who worked in mines which were closed lost their jobs. Given that most mine workers are locals there will clearly have been an increase in the number of unemployed or underemployed farmers. This occurred against a background of static rural employment and falling employment in agriculture (Table 5). Two further consequences of the closure campaign relate to the compensation paid to farmers and the failure to reclaim the mine land. It appears to be standard practice in the study areas, and also across China, for mines of all sizes to pay compensation to those who had previously farmed the land on which the mine was constructed. In counties such as Tongliang, this had been made as a one-off payment. In Tianfu the farmers received an annual payment which would have ended on the closure of the mine. Farmers in this position would thus have lost a source of revenue. This might not matter if the land destroyed by the mining had been rehabilitated, but this has not happened. Indeed the national programme to close the TVCMs contained no measures to encourage or enforce rehabilitation (Andrews--Speed et al., 2003). Thus farming communities have lost employment, in some cases have lost a flow of cash from those using the land for mining, and have not had their land returned in a useable condition.

Local enterprises experienced a sharp rise in the price of coal. This will have had a significant financial impact on local energy-intensive industries such as brick-making, chemicals and power generation. In some instances, the reduction in coal output seems to have led to some users having to seek coal supplies from outside their counties.

Of the local governments, only Tianfu and Yongchuan reported significant reductions in government revenue from coal mining, though the statistics available are not complete (Table 9c). These are both regions which were heavily dependent on coal revenues before the mine closure campaign and which remained so afterwards. In at least one county, Yubei, payment was received by the county government from the central government in compensation for the economic loss suffered by the local government. In Yubei this amounted to RMB Y 500,000.

Economic responses to the closure campaign in the case studies

The main economic impacts of the TVCM closure campaign have been a reduction in employment in coal mining, a general but not ubiquitous reduction in the level of revenue to government and enterprises from coal sales, a fall in the local output of coal and a rise in the price of coal. Two types of response have been observed in the cases studied, in addition to those responses directly related to the mines themselves. The first involves the encouragement of new types of economic activity and the other involves the progressive introduction of natural gas as a source of energy.

Both Yubei and Tongliang counties have encouraged the development of commercial agriculture and animal husbandry through the provision of low interest loans, grants and the construction of infrastructure such as roads and water supplies. Neither Yubei nor Tongliang were heavily dependent on the TVCMs for revenue and employment and both have experienced continuing economic growth and only a modest fall in employment rates (Tables 2 and 3). Therefore it will have been relatively easy for these county governments to divert a limited amount of resources to the townships to compensate for the mine closures, especially as Yubei received compensatory funds from central government.

Rongchang and Yongchuan already had long-standing light engineering industries and have encouraged the growth of these industries. The new employment opportunities have generally appeared not in the townships and villages but in the county towns. Tianfu and Yongchuan have promoted the expansion of existing quarrying for construction materials, through the provision of low interest loans in the case of Tianfu.

Rongchang, Tongliang and Tianfu were and remain heavily dependent on coal mining. Despite the mine closures and reduction of employment, the output of coal from Rongchang was unchanged by the mine closure programme (Table 6c). With a low and barely growing GDP and a rapidly falling employment rate, Rongchang will necessarily have resisted attempts to reduce its total output of coal. In contrast Yongchuan's economy has been more successful over the period of the mine closure programme and employment levels as a whole have only fallen modestly (Tables 2 and 3). In Tianfu itself, it appears that few new jobs have been created, but that workers laid off from the mines were able to find jobs elsewhere in Beibei, a rich and highly urbanised county.

With respect to energy supplies, as was mentioned above, the closure of the TVCMs led to rising coal prices and local shortages. Two types of response have been reported. In Yubei and Yongchuan, the use of natural gas was increased. In the other case study areas, this option was either not possible or was too expensive. In Tianfu, the local residents resorted to using wood, despite the relative local abundance of coal.

Summary of the case studies

The responses of the governments in the five case studies have been summarised in Table 10. In all cases, the local government sought to comply with the policy of closing substantial numbers of township and village coal mines. In three counties, the government was apparently successful in developing on or building on alternative economic activities (response type 1). The two counties which were not heavily dependent on coal mining, Yubei and Tongliang, appear to have been successful in building on alternative forms of economic activity. It appears that employment levels in the TVCMs in Tongliang have not fallen much, suggesting a high degree of over-employment or, possibly, of part-time employment in these mines.

Yongchuan has also made substantial progress in this respect, despite the importance of coal mining in this county. Possibly because of this dependency, the proportional fall of coal output in Yongchuan is lower than all the other cases except Rongchang. Thus the response of Yongchuan has an element of response type 3, raising the output of remaining mines.

Rongchang is the prime example of response type 3. Coal output has remained unchanged despite the mine closures and despite the reduction in employment levels in TVCM.

Table 10
Summary of responses to mine closure campaign in the five case studies

Type	Response	Highly dependent on coal	Not highly dependent on coal
1.	To comply with the mine closure campaign and successfully develop alternative economic activity	Yongchuan county	Yubei county, Tongliang county
2.	To comply with the mine closure campaign and fail to develop alternative economic activity	Tianfu township (but jobs available in other parts of Beibei county)	
3.	To comply with the mine closure campaign but raise output in the remaining mines	Rongchang county	
4.	To fail to comply with the mine closure campaign and allow mines to continue in operation		

This reflects the high degree of dependency of the local economy on coal mining and the inability of the local government to stimulate alternative forms of economic activity at short notice.

Tianfu township itself has reduced coal output through mine closure, but has failed to generate new economic activities within the boundaries of the township because of its location and its historic dependency on coal mining and quarrying for construction materials (response type 2). The source of compensation has lain in the rest of Beibei county to which this township belongs and where other forms of employment have been available.

Conclusions

Planning for mine closure is progressively becoming recognised as an important component of the management of the mining sector. To date, emphasis has been placed on formulating approaches to address the negative impacts of the closure of large-scale mines. Though the environmental aspects of mine closure have played a routine part in mine planning in many countries, the socio-economic challenges have only recently started to receive systematic attention.

Mine closure in the small-scale mining sector has received little attention as the priority has been to regularise the mining activity itself rather than to plan for mine closure. The effective planning and implementation of closure programmes for small-scale mines will face even greater challenges than those faced by large-scale mines. In most locations a lack of skills, financial resources and political will result in little planning for mine closure and a high degree of variability in the response to mine closure. A few governments have drawn up plans and regulations address the need for mine land rehabilitation after the closure of small-scale mines, but the socio-economic impacts seem to remain a policy vacuum.

In 1998, China embarked on a radical campaign to close tens of thousands of small-scale coal mines across the country. The plans were drawn up and executed with such alacrity that there was no opportunity to address in advance the environmental and socio-economic impacts of the closure programme. The potential negative socio-economic impact of the closure campaign was exacerbated by the continuing and long-standing trend for falling employment in agriculture and consequent migration of peasants to the cities.

This study has examined five coal-mining areas in Chongqing Municipality in order to evaluate the economic impact of the closure campaign and to examine the nature of the response of the local government and community. In all five cases the local government did indeed appear to have responded to the central government's campaign by closing significant numbers of small-scale coal mines, laying off large numbers of workers and leaving mine owners with no compensation. In three of the five cases the local government were able to build on existing economic activities outside the coal mining sector. In two of these cases (Yubei and Tongliang counties) the previous dependence on coal mining was minor and therefore the task of adapting to the closure of the coal mines would have been relatively straightforward. In the other case (Yongchuan county) coal mining had played an important role in the economy, as indeed it continues to do. However, even here the government was able to build on the existing light engineering and quarrying sectors to minimise the economic impact of the mine closures.

In the two other cases the local governments were unable to develop or to build on alternative economic activities. The township government of Tianfu seems to have received little support from the relatively rich county government of Beibei and it is likely that residents of Tianfu will have had to leave their homes to find employment in other parts of the county. Rongchang is poorest and most remote of the five counties, and remains heavily dependent on the small-scale coal mines. As a result, having responded to the campaign by closing a number of mines, the local government allowed the new owners of the remaining mines to invest in new capacity so that total output could be maintained.

These cases show that a lack of forward planning need not necessarily lead to disaster. Local governments have been able to respond relatively quickly to constrain the negative economic impacts of a closure programme for small-scale mines. However, the effectiveness of that response has depended on the pre-existing economic conditions in the respective county. It would have been desirable and very possible for the Chongqing municipal government to have drawn up a strategy which identified those counties which were most exposed to an economic downturn resulting from the closure of the mines, and to have targeted resources at these counties to minimise the negative impacts.

Compared to many other small-scale mining regions of the world, Chongqing has many advantages. During the period under consideration the average annual growth of GDP in Chongqing, as across much of China, was 8–9%, while the population grow at less than 0.25% per year. Though Chongqing Municipality is not one of the richest regions of China, it is far from the poorest and it is successfully attracting new investment, including from overseas. China has a multi-tired system of government which provides strong links different levels of government. Though the system has many weaknesses, it is undoubtedly more effective at formulating and implementing policy than in some of the world's poorest countries where many small-scale miners live. In addition, the mining areas examined all lay within 100 km of the city of Chongqing, which has a population exceeding 10 million and a strong and ambitious government. Most small-scale mining provinces elsewhere in the world lack these advantages and will therefore be unable to react so effectively to an enforced programme of

mine closure unless higher levels of government become directly involved in the formulation of policies and the provision of resources to implement these policies.

A final caveat recognises that although county governments have shown some ability to counteract the negative impacts of the mine closure campaign with respect stimulating economic activity within the county, the benefits of these policies have not necessarily filtered down to the townships and villages where the mines were located. Indeed, in the one case study of a township, the county had clearly failed to help the township directly. In all areas studied mine owners, mine workers and farmers whose lands were occupied by mines received no compensation. So, behind stories of qualified success at county level probably lie cases of economic disadvantage at township and village level which were not effectively examined by this study.

References

Andrews-Speed, P., 2004. Energy Policy and Regulation in the People's Republic of China. Kluwer Law International, The Hague.

Andrews-Speed, P., Yang, M., Shen, L., Cao, S., 2003. The regulation of China's township and village coal mines: a study of complexity. Journal of Cleaner Production 11, 185–196.

Ayree, B.N., 2003. Small-scale mining in Ghana as a sustainable development activity: its development and a review of the contemporary issues and challenges, in: Hilson, G.M. (Ed.), The Socio-economic Impacts of Artisanal and Small-scale Mining in Developing Countries. A.A. Balkema, Lisse.

Brook, D., 1994. Reclamation of abandoned underground mines in the United States. Mineral Planning 61, 21–26.

Burke, G., 1997. Policies for small-scale mining: the need for integration. Journal of Mineral Policy, Business and Environment 12 (3), 11–14.

Chilean Copper Commission, 2002. Research on mine closure policy, in: Mining for the Future, International Institute for Environment and Development, Paper No. 44.

Clark, A.L., Clark, J.C., 1999. The new reality of mineral development: social and cultural issues in Asia and Pacific nations. Resources Policy 25, 189–196.

Cook, S., Maurer-Fazio, M., 1999. The Workers' State Meets the Market. Frank Cass, London.

Ghose, A.K., 2003. Small-scale mining in India: past, present and the future, in: Hilson, G.M. (Ed.), The Socio-economic Impacts of Artisanal and Small-scale Mining in Developing Countries. A.A. Balkema, Lisse.

Green, S., in press. China's industrial reform strategy: privatization and state control, in: Green, S., Liu, G. (Eds.). Exit the Dragon? Privatization and State Ownership in China. Royal Institute for International Affairs, London.

Gunson, A.J., Yue, J. 2002. Artisanal mining in the People's Republic of China, in: Breaking New Ground: Mining, Minerals and Sustainable Development. International Institute for Environment and Development, London.

Hollaway, J., 1986. The small-scale mining sector in Africa; restructuring for profitability. Natural Resources Forum 10 (3), 293–297.

Hollaway, J., 1999. Lessons from Zimbabwe for best practice for small- and medium-scale mines, in: Warhurst, A., Noronha, L. (Eds.), Environmental Policy in Mining. Corporate Strategy and Planning for Closure. Lewis Publishers, Boca Raton, FL.

Hollaway, J., 2000. Lessons from Zimbabwe for best practice for small- and medium-scale mines. Minerals and Energy 15 (1), 16–22.

Horii, N., 2001. Development of small-scale coal mines in market transition and its externality, in: Horii, N., Gu, S. (Eds.), Transformation of China's Energy Industries in Market Transition and its Prospects. Institute of Developing Economies, Chiba, Japan.

Hoskin, W.A., 2004. Mine closure–the 21st century approach. Avoiding future abandoned mines, in: Bastida, A.E., Waelde, T.W., Warden-Fernandez, J. (Eds.), International and Comparative Mineral Law and Policy. Kluwer Law International, The Hague.

Jackson, R.T., 2002. Capacity building in Papua New Guinea for community maintenance during and after mine closure, in: Breaking New Ground: Mining, Minerals and Sustainable Development, Paper No. 181. International Institute for Environment and Development, London.

Kahn, J.R., Franceschi, D., Curi, A., Vale, E., 2001. Economic and financial aspects of mine closure. Natural Resources Forum 25, 265–274.

Khanna, T. (Ed.), 2000. Mine Closure and Sustainable Development. Results of a Workshop organised by the World Bank Group and the Metal Mining Agency of Japan. Mining Journal Books, London.

Kuhne, G., 1992. Abandonment and reclamation of energy sites and facilities: Germany. Journal of Energy and Natural Resources Law 10 (1), 4–20.

Kumar, R., Amaratunga, D., 1994. Government policies towards small-scale mining. Resources Policy 20 (1), 15–22.

Labonne, B., 2003. Seminar on artisanal and small-scale mining in Africa: identifying best practices and building the sustainable livelihoods of communities, in: Hilson, G.M. (Ed.), The Socio-economic Impacts of Artisanal and Small-scale Mining in Developing Countries. A.A. Balkema, Lisse.

Laurence, D.C., 2002. Optimising mine closure outcomes for the community—lessons learnt. Minerals and Energy 17 (1), 27–34.

Li, H., Rozelle, S., 2003. Privatizing rural China: insider privatization, innovative contracts and the performance of township enterprises. China Quarterly 176, 981–1005.

Macedo, A.B., Mello Freire, D.J.A., Akimoto, H., 2003. Environmental management in the Brazilean non-metallic small-scale mining sector. Journal of Cleaner Production 11, 197–206.

Meyer, P.B., Williams, R.H., Young, K.R., 1995. Contaminated Land—Reclamation, Redevelopment and Reuse in the United States and the European Union. Edward Elgar, Cheltenham.

Mining Minerals and Sustainable Development, 2002. Minerals and economic development, in: Breaking New Ground: Mining, Minerals and Sustainable Development, Chapter 8. International Institute for Environment and Development, London.

Mining Minerals and Sustainable Development, 2002. Mine closure working paper, in: Breaking New Ground: Mining, Minerals and Sustainable Development, Paper No. 34. International Institute for Environment and Development, London.

Mining Minerals and Sustainable Development, 2002. Local communities and mines, in: Breaking New Ground: Mining, Minerals and Sustainable Development, Chapter 9. International Institute for Environment and Development, London.

Mining Minerals and Sustainable Development, 2002. Artisanal and small-scale mining, in: Breaking New Ground: Mining, Minerals and Sustainable Development, Chapter 13. International Institute for Environment and Development, London.

Redgwell, C., 1992. Abandonment and reclamation obligations in the United Kingdom. Journal of Energy and Natural Resources Law 10 (1), 59–86.

Roberts, S., Veiga, M., Peiter, C., 2000. Overview of Mine-closure and Reclamation in the Americas. International Development Research Center, Vancouver.

Rocha, J., Bristow, J., 1997. Mine downscaling and closure: an integral part of sustainable development. Minerals and Energy 12 (4), 15–20.

Shi, X., 1999. Analysis, consideration and proposals concerning the programme to close mines and restrict output. Coal Economic Research 6, 18–21 (in Chinese).

Sinton, J.E., 2001. Accuracy and reliability of China's energy statistics. China Economic Review 12, 373–383.

Sinton, J.E., Fridley, D., 2000. What goes up: recent trends in China's energy consumption. Energy Policy 28, 671–687.

Smil, V., 2000. China's energy and resources uses: continuity and change, in: Edmonds, R.L. (Ed.), Managing the Chinese Environment. Oxford University Press, Oxford.

Thomson, E., 1996. Reforming China's coal industry. The China Quarterly 147, 726–750.

Veiga, M.M., Scoble, M., McAllister, M.L., 2001. Mining with communities. Natural Resources Forum 25, 191–202.

Wang, X., 2000. Always emphasise the importance of the task in mine closure and production reduction. Coal Enterprise Management 2000 (2), 9–10 (in Chinese).

Wang, F.L., 2004. Reformed migration control and new targeted people: China's Hukou system in the 2000s. China Quarterly 177, 115–132.

Warhurst, A., Noronha, L. (Eds.), 1999. Environmental Policy in Mining. Corporate Strategy and Planning for Closure. Lewis Publishers, Boca Raton, FL.

World Bank, 2002.Anon., 2002. Its Not Over When Its Over. Mine Closure Around the World. World Bank, Washington, DC.

Wright, T., 2000. Competition and complementarity: township and village mines and the state sector in China's coal industry. China Information 14 (1), 13–129.

Zhang, B., 1999. Text of speech at a meeting on the closure of illegal and irrationally located mines, 11th November 1998, in: Selected Documents on Mine Closure and Output Reduction in China's Coal Sector. Coal Industry Publishing House, Beijing (in Chinese).