Geological Information

Pre-investment to Maximize Value

1. Introduction

Precept 4 of the Natural Resource Charter argues that countries can benefit from their governments providing geological information to private firms. However, very few developing country governments have done this. This creates an opportunity for international donor organisations to fund such programmes. This has been done. For instance, as of [date]. the World Bank has funded 13 geodata projects in developing countries.

This paper is a collection of case studies of country experiences in their attempts to provide greater geological information:

- Papua New Guinea
- Botswana
- Afghanistan
- Canada

This paper firstly provides a summary of the reasons why public geodata is important.

2. The case for public provision of geological survey information

Geological information as a public good

Publicly available information about the geological composition of a country is a *public good*: much of the benefits do not accrue to the person who produces the information. For instance, say that an exploration firm discovers a new mineral deposit. This is beneficial to the firm, since it can extract the mineral and sell it. Yet it is also beneficial to others as the presence of one mineral deposit is an indication of further mineralization in the area. Other firms, acting on this piece of information, can now focus their exploratory efforts around the site of the first discovery. This sounds good for the country as more natural resource wealth can be found, but it is actually a problem because if the costs of geological information are higher than the benefits that accrue to the private exploration firm, no information will be produced at all.

For initial geological surveys (part of *extensive* exploration or *greenfield* exploration), this problem is most acute. In such cases, there is a strong argument in favour of the government helping to produce geological data. This is the same argument to support government funding of university research.

Geological information to increase competition in auctions

As well as making geodata public, ensuring the government has geodata itself is useful for getting a high value from selling extraction rights.

If the government knew everything there was to know about its resources, the operational capability of extraction companies, and so forth, getting the maximum value from the sale of extraction rights would be straightforward.

Of course, such perfect information is not available to either parties. Indeed, countries, and their agents, their governments, may not know much about the value of their resources and even less about the capabilities and preferences of prospective resource companies.

In these circumstances, the best way to assign exploration/extraction rights is via an auction (see Precept 4). The competitive bidding of participants in an auction does a lot of the hard work for the government, revealing much of the information required to maximise the value of the sale.

However, a pre-requisite to successful competition for prospecting licenses or auctions for exploration and development rights is to provide sufficient information to the market so that those with the capability and interest are present and willing to compete. In other words, there needs to be some minimum level of information available to bring participants to the auction. With respect to the auctioning of exploration and extraction rights, geological information is the most important.

3. Papua New Guinea

As part of the Mining Sector Institutional Strengthening initiative, the World Bank undertook a project for the development of a Geographical Information System (GIS) in 2002.[1] The aim of the project was to digitally capture all existing historical exploration data and integrate it with available geological, geographical, geophysical and geochemical datasets. During Phase 1 of the project data covering around 60 per cent of the land area of Papua New Guinea (PNG) was processed and entered into the GIS. The GIS was then made freely available to interested companies for a modest fee. Immediately following release of the data the number of new exploration licenses increased – approximately five times the number of license applications were received in areas covered by digitized data compared to areas not digitized. PNG mining law now requires licensees to submit annual exploration reports that detail geological, geochemical and geophysical results obtained. This data remains confidential during the term of the exploration license but is added to the public database on relinquishment or expiry of the confidentiality term. This lowers the cost of entry and encourages new prospecting, particularly by junior exploration companies.

[1] See World Bank web page. Available at: http://go.worldbank.org/450JP1Z6C0

A second project was a regional airborne geophysical survey of magnetics and radiometrics. A number of new areas of intrusive igneous rocks and deep magnetic anomalies that are corollaries of existing large scale copper and gold projects were identified. These were in areas that had not been seriously explored due to incomplete or inaccurate geological maps. Again there was an immediate rise in the number of exploration licenses in the areas of interest identified.

4. Why donors may be best placed to fund public geodata projects

The immediate policy recommendation therefore is for governments to undertake more geological surveys and data provision initiatives. A question arising from this recommendation is why do government not do this already? What advice can be given to remove barriers to information provision by government?

Gelb et al. (2012) suggest three constraints facing governments in low income countries. In most cases, donors can play a role in sidestepping these constraints:

- *Credit constraints*. Link between public information and higher revenue for government is too long and uncertain. Risk is still high for individual governments. Better for international agencies to bear the risk – diversified over a group of countries the portfolio risk will be lower for the donor.
- *Capacity*. Reedman et al. (2002) find that the government ministries normally responsible for public geodata provision lack the necessary capacity. This should not present a problem. Consultants can be used to undertake initial surveys, perhaps funded by donors.
- *Transparency*. Lastly a culture of open information does not exist in many countries. Some elements of the strategies in these case studies requires transparency structures. So part of it is getting the transparency problem right.

5. Botswana

Botswana has a highly successful diamond industry dating back to the formation of the Debswana JV with De Beers in 1969. The Selebi-Phikwe copper-nickel deposit is also significant but revenues from copper and nickel are less than ten per cent of those from diamonds. A challenge for Botswana is both renewal of the diamond industry and diversification into other minerals.

As part of a program of reform to make the mining sector more competitive the government amended the Mines and Mineral Act in 1999 to improve security of tenure for explorers via a defined system of Prospecting, Retention and Mining licenses. They also invested in a National Integrated Geo-Science Information System (NIGIS) and new facilities for the storage and inspection of samples. Exploration companies are required as a license condition to submit quarterly reports of exploration activity and geological information – as with the PNG case, these remain confidential until licenses are relinquished when they are added to the available public database. As a result exploration activity has been on an increasing trend not only for diamonds but also for copper nickel, coal and coalbed methane. One of the geological challenges for Botswana is the extensive Kalahari sand cover which requires sophisticated sampling with geophysical techniques. Extrapolation from known data points available in the central database might help reveal what lies below the surface geology.

Upon application for a mining license, companies must submit copies of feasibility reports, including the geotechnical and economic modeling. This enables the government to subject the information to third party assurance to validate or dispute the stated levels of deposits and investment. These form the basis for agreeing mining plans and estimating revenue for subsequent regulation of the operating company, as well as setting realistic expectations for employment, investment and government revenue.

6. Afghanistan

Bulk commodities require linkages to world markets if their value is to be maximized. For landlocked countries this primarily means rail infrastructure linking to ports, though supporting direct mining activity with power, roads, water and social infrastructure is also important. The cost of such infrastructure is often too great to be borne by one project so that multiple opportunities are required to initiate development and the infrastructure should be laid along identified resource corridors where future developments are most likely. Once in place the presence of infrastructure can stimulate future prospecting and development and also spur the development of secondary and service industries that supply the natural resource industry.

Identification of prospective resource corridors requires a good understanding of regional geology which can then be overlain on potential infrastructure routes. The World Bank is providing technical assistance to the government of Afghanistan through its Sustainable Development of Natural Resources Project supported by both DFID and USAID and their respective geological surveys. One of the aims of this work is to develop a National Spatial Data Infrastructure (NDSI) set of databases for the Afghan Geological Survey that will integrate historical reports translated from Russian and Dari with more recent data from techniques such as airborne geophysics and satellite sensing. The auction of the Aynak copper deposit near Kabul has started regional infrastructure development, with re-enforcement from the planned auction of the Hajigak iron ore deposit 130km west of Kabul. Prospective areas and favorable geology for

chromite and copper mineralization between Kabul and Kandahar have been identified which may influence the routing of future infrastructure. An area around the Sheberghan gas field in the north west of the country is another potential node for transport development.

7. Canada

The Prospectors and Developers Association of Canada (PDAC) has prepared a comprehensive report setting out the benefits of public geoscience.[2] The scope of the report is broad and explains why Governments need geoscience information to formulate and implement public policies in such areas as resource development, environmental protection, and infrastructure planning.

On the narrower point of enabling and stimulating competition the executive summary states:

> *"There is ample evidence that government geoscience stimulates private sector exploration. Program evaluations suggest that 6 of 10 mapping projects will have immediate impact in terms of claim staking or new exploration activity. The incremental exploration expenditures resulting from new public geoscience are more difficult to quantify and depend on location and timing in the business cycle of government action. Nevertheless, the often cited rule-of-thumb that $1 in government spending results in $5 in private sector exploration appears to be a reasonable expectation over the medium term."*

The PDAC concludes that mineral industry users of geoscience data are almost unanimous in their view that government geoscience increases exploration efficiency and effectiveness, but there have been few efforts to quantify these impacts. Surveys of diverse user groups suggest efficiency improvements of 5 to 20 percent, but the impact could well be greater in the early stages of mineral exploration.

8. Conclusion

Precept 4 argues that public provision of geological information is likely to have significant benefits from a country. While few studies have quantified a return on information provision, the Canadian case study as well as Reedman et al. (2002) suggests that it can be large.

[2] Duke, J. M. (2010) "*Government geoscience to support mineral exploration: public policy rationale and impact*" Prepared for Prospectors and Developers Association of Canada.

References

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