Prospects for Tanzania's Mining Sector

Per Granberg

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Summary

The success of Tanzania's structural reform efforts will *(inter alia)* depend on its ability to generate foreign exchange incomes. Mineral exports seem a promising source of such incomes. Tanzania is reportedly well endowed with minerals, with considerable developments already under way to explore them. Any attempt to make plans for the Tanzanian economy must take this into account. The present paper, which is part of the larger Macmod project, aims to make a contribution towards this end. It seeks to assess the prospects for mining developments in Tanzania during the next few years, and to propose a set of quantitative estimates indicative of these developments. In so doing the focus is limited to the standard economic variables of production and investments.

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1 : Introduction

The success of the Tanzania structural reform policy will ultimately depend (*inter alia*) on the country's ability to earn foreign exchange incomes. Mineral exports are often considered a typical source of such incomes. This also seems a promising option in Tanzania's case: the country is understood to be fairly well endowed in terms of gold and other types of mineral deposits. Considerable developments, both in terms of prospecting and of productive investments, are reportedly under way, in order to explore these deposits.

Thus, according to the South African Department of Finance (see SADepFin/SADC): "Tanzania is rich in mineral resources. Investment is, however, required to upgrade technology and renew ageing plant and machinery.... Some analysts are predicting that Tanzania could become the third biggest gold producer in Africa, after Ghana and South Africa. Other minerals include gemstones, coal, phosphates, iron, and to a lesser extent, tin, salt, gypsum and kaolin. Nickel deposits have also recently attracted important new investment in the sector."

Representatives of the Tanzanian government have made similar claims. In a 1998-interview with the South African newspaper Business Day the Tanzanian Deputy Mining Minister stated that (see Dodd (1998)):

- Tanzania aimed to lift annual gold exports from the 1998-level of approx. 0,5 ton to 26 tons by the year 2001 when there would be four or five gold mines in operations.
- Of nine major companies operating in Tanzania, seven were attracted by gold. Investment in prospects nearing production would reach $360m over the period 1998-2000.
- Mining exploration, mainly gold related, had risen rapidly during the period 1993-98 with estimates of proven Tanzanian gold reserves at about 20-million ounces and annual exploration expenditure jumping to $80m.
- The embryonic mining sector, dominated by gold, accounted for about 2% of gross domestic product (GDP) in 1998, but was expected to rise to between 10% and 15% within five years.
- Tanzania is also a significant diamond producer, mostly via De Beers subsidiary, Williamson Diamonds. After declining from 300 000 carats in the early 1980s to 68 000 carats in 1992, production has shot up to 120 000 carats after rehabilitation of the mine.

The above statements give a definite impression of high expectations. If proven right, they will obviously have significant positive impact on the economic situation of the country. *Vice versa*, a failure to meet these hopes will evidently mean the loss of such an impact. Any attempt to formulate forecasts or plans for the Tanzanian economy ought to take this into account.

Ideally, such efforts ought to be based on "firm and realistic" predictions about the volume etc of future mining activities. In practise, however, one must recognise the fact that the future is both unknown and uncertain, and that this is also very much the case for the mining sector. The best one can in practise hope to achieve is to base our efforts on "best guesses" or "considered opinions" or similar.

The present paper, which is part of the Macmod project, aims to make a contribution towards this end. It seeks to assess the prospects for mining developments in Tanzania during the next few years, and to propose a set of quantitative estimates indicative of these developments. In so

doing the focus is limited to the standard economic variables of production and investments. This, of course, is not to deny that the development of the mining sector will impact the nation in a variety of ways, for instance with respect to environmental issues, land use issues etc. These, however, are outside the limited scope of the present paper.

2 : The setting

2,1: The mining sector during the 1990s

The aim of this paper is to assess developments in Tanzania's mining sector during the next few years. Before doing so, however, it may be worthwhile to take a quick look at the setting for these developments, i.e. at the existing situation in the sector, and the developments it has undergone during recent years.

Table 2,1 portrays Tanzania's overall real-term GDP growth and the corresponding GDP growth in mining. It is readily seen that mining and quarrying has outgrown the rest of the economy during the 1990s, and that it has done so both consistently and considerably. The growth rates achieved in the mining sector are impressive by most standards, and especially so for the last two years (1997 & 1998). The impression given by table 2,1 therefore tallies with the bright prospects for the sector indicated above.

Table 2,1 : Real-term growth in total national GDP, and in mining GDP (TZS'mill. at constant 1992 prices)

	Total GDP at factor cost		of which: Mining Sector's GDP	
	Value (TSZ'mill.)	Growth (%pa)	Value (TSZ'mill.)	Growth (%pa)
1990	1 219 236	NA	11 226	NA
1991	1 253 134	2,8 %	12 536	11,7 %
1992	1 275 917	1,8 %	13 503	7,7 %
1993	1 281 006	0,4 %	14 608	8,2 %
1994	1 298 942	1,4 %	16 803	15,0 %
1995	1 345 246	3,6 %	18 768	11,7 %
1996	1 401 711	4,2 %	20 579	9,6 %
1997	1 448 214	3,3 %	24 097	17,1 %
1998	1 505 826	4,0 %	30 700	27,4 %

Source: BOT web site

Table 2,2 provides a slightly different picture of the mining sector. The table pictures Tanzania's total GDP, and the share attributed by the mining sector. The brisk growth of the mining sector is reflected in the fact that the sector has increased its percentage contributions to Tanzania's overall GDP fairly steadily throughout most of the 1990s. Even so, the table makes it quite clear that the mining sector has been, and still is, a rather insignificant contributor to Tanzania's total economic activity, accounting for no more than approx. 1% of Tanzania's overall GDP.

Table 2,2 : Total national GDP, and the part of it attributed to mining (TZS'mill. at current prices)

Year	Total GDP (factor cost)	of which: Mining	Mining as % of total
1 990	760 005	6 525	0,9 %
1 991	989 594	8 840	0,9 %
1 992	1 275 917	13 503	1,1 %
1 993	1 607 763	19 062	1,2 %
1 994	2 125 324	26 170	1,2 %
1 995	2 796 642	35 190	1,3 %
1 996	3 452 558	38 511	1,1 %
1 997	4 281 600	53 515	1,2 %
1 998	5 125 311	74 386	1,5 %

Source: BOT web site

Table 2,3 similarly portrays Tanzania's total commodity exports, and the part of it attributed to mining. The latter is seen to account for a significantly higher share of exports than of GDP. Mining is consequently one of Tanzania's more export-oriented sectors. But even so, with export-shares mostly in the region of 5-10%, mining can hardly be counted among Tanzania's major export earners. Moreover, the export-share is seen to have declined significantly during the 1990s.

Table 2,3 : Total exports, and the part of it attributed to mining (TZS'mill. at current prices)

Year	Total Exports	of which: Minerals	Minerals in % of total
1 990	66 561	3 620	5,4 %
1 991	75 981	8 479	11,2 %
1 992	123 966	12 920	10,4 %
1 993	181 148	28 074	15,5 %
1 994	265 177	15 390	5,8 %
1 995	390 378	25 545	6,5 %
1 996	455 419	31 450	6,9 %
1 997	459 549	31 303	6,8 %
1 998	391 805	17 509	4,5 %

Source: BOT web site

Table 2,4 illustrates the commodity structure of Tanzania's mineral export. The data cover the period 1990-92 only, but are nevertheless suggestive of a general structure that seems valid even today. Thus, as already indicated earlier:

- Precious rather than base minerals represent the backbone of Tanzania's mining exports, and probably also of its mining production.
- Gold is by far the most important mineral produced.

Table 2,4 : Mineral exports by commodity

	Value (US$'million)			Percentage distribution		
	1990	1991	1992	1990	1991	1992
Gold	13.6	29.1	40.4	51.8%	65.7%	76.0%
Diamonds	10.0	11.9	8.4	38.2%	27.0%	15.8%
Gemstones	1.6	1.7	3.2	6.1%	3.8%	6.0%
Salt	0.9	1.5	1.0	3.4%	3.4%	1.9%
All other	0.1	0.0	0.2	0.5%	0.1%	0.3%
Total	26.3	44.0	53.2	100.0%	100.0%	100.0%

Source: Nanyaro (1994)

Table 2,5 portrays the production of precious minerals during the period 1990-98. The table gives an immediate impression of volatility; there are remarkably large variations in annual production for each of these three commodities. The case is especially clear for gold, which grew from 1.64 tons in 1990 to 4.53 tons in 1992, only to fall back to 0.23 tons in 1997.

Table 2,5 : Mineral Recoveries

Item	Unit	1990	1991	1992	1993	1994	1995	1996	1997	1998
Diamond	000'Carat	85	100	67	41	26	50	127	123	95
Gold	000'Kg	1.64	3.78	4.53	3.37	2.86	0.32	0.32	0.23	0.43
Gemstone	000'Kg	38.7	59.6	48.9	33.0	48.5	111.4	137.2	124.6	48.5

Source: BOT web-site

The near collapse of gold mining may seem to refute the high hopes for the sector. Before drawing such a conclusion, however, a closer look into the background for these events is in order. Doing so, it soon becomes clear that the developments depicted by table 2,5 must in large measure reflect the small-scale, "quasi-informal" nature of the Tanzanian mining industry.

During the 1990s Tanzania had few if any operational mines of the type commonly found in richer countries, i.e. large, capital intensive operations. The mining structure of Tanzania, in contrast, has been one of "hundreds of small gold occurrences and deposits...operated by more than 500,000 artisanal miners and a couple of semi-mechanized small companies".[1] The state-owned Buckreef mine appears to have been the only large-scale gold mine in operation at the dawn of the 1990s. When it closed down in 1990 it left "the country once again without a commercial gold mine."(Nanyaro (1994)) [2]

Mining in Tanzania during the 1990s may consequently be described as a small-scale labour intensive activity. The sector consisted of a host of simple private-sector operations, simple in technology and low in fixed investments. The mines were manned by an army of workers, many of whom may have tended to look upon mining as a seasonal occupation, or to migrate between mining and other sectors in pursuit of an acceptable income. Richer prospects (relative to other

[1] Roughly the same structure applied for gemstone and diamond mining (according to Nanyaro 1994)

[2] Another source of information on African affairs, the South African web-site: Mbendi, states that: "Most of Tanzania's gold prospects are located in the greenstone belt south of Lake Victoria, where commercial mines operated in the 1950s but later closed for economic reasons." (MBendi TzMine)

low-skill alternatives) may therefore have attracted a surge of new entrants into the sector (and *vice versa* for poorer prospects).

This is apparently what happened in the early 1990s. As argued by Nanyaro (1994) the growth in gold production resulted from the introduction of new mining policies, and competitive producer prices. Thus:

- In May 1990 gold mining and selling activities were liberalised. As from that date, anyone could sell gold to appointed banks, at competitive market prices, with no question asked.
- The Buckreef mine suspended operation in 1990, leaving the country without "commercial" gold mining activity. Even so, gold production rose sharply, reaching an all time record of 4.5 tonnes in 1992. The dramatic rise was a result of very active participation by artisanal miners (very small-scale miners) who were motivated by the new liberal mining policy and the good prices offered them.

The realities behind the dramatic decline in gold mining reported in recent years are not immediately obvious; neither the true extent nor the underlying reasons for the decline seems clear. Focusing on the first issue it may be noted that the veracity of the dramatic production decline depicted in table 2,5 may be subject to dispute. This is because these estimates, which we interpret in terms of *actual* mineral *extraction*, do in fact record *reported* mineral *sales*. The latter may differ considerably from the former if sales are under-reported (for tax reasons), production smuggled in/out of the country (due to differences in local prices) or similar.

It is common knowledge that significant quantities of gold and precious stones have been smuggled out of Tanzania over the years. One observer (Chachage (1995)) even argues that large-scale smuggling of gold occurred also during the early 1990s, i.e. when local gold sales were record high. The subsequent fall in local gold sales may therefore reflect increased smuggling, at least in part. The argument is lent some support by the Tanzanian authorities. Describing the state of the Tanzanian mining industry in 1998 the Deputy Mining Minister maintained that: "smuggling to Kenya by small-scale miners who currently dominate gold production accounted for more than official exports" (Dodd (1998))

Even so it seems difficult not to conclude that gold mining must have suffered a considerable decline during recent years. The underlying reasons are not immediately obvious, but the following may be offered as a (partial) suggestion. "Pick and shovel" operations of the kind described in the above will typically have to limit their activity to the easy-to-extract surface-deposits. The rewards reaped from such gold fields will tend to decline after a while, and especially after a period of rapid excavation activity. Sooner or later the miners in question will want to move on to richer fields. These, however, may be difficult to find, especially towards the end of a "gold rush" era. The result may be a serious drop in production, as mine-hands move on to other sectors in pursuit of better incomes.

The industry will consequently go into decline. This, however, may be no more than a temporary occurrence, lasting until fresh exploration areas are found. Even if such areas, suitable for today's small-scale mines, should fail to materialise, however, other types of mining are not necessarily ruled out. The fact that Tanzania's traditional gold miners may have experienced hard times does therefore not rule out the possibility that there may exist rich opportunities in mining zones left

untouched by these miners. In Tanzania's case these zones may possibly include the greater part of the country's potential below-surface deposits.

2,2: Prospects for the future

In view of the above discussion it would therefore seem unwise to take the mining sector's performance in the past as a guide to the future. Crucial policy changes, both in respect of mining and other sectors, have been introduced to address the problems experienced in the past. While the then economic regime tended to be stagnant and inward looking, the new policies endeavour to turn the economy towards greater openness, both with respect to private enterprise and foreign investments.

According to the Bank of Tanzania (BOT) these efforts are bearing fruit: considerable amounts of foreign investments are now directed towards Tanzania, indicating the renewed confidence of the international business community in Tanzania's economic prospects. Thus, in its Annual Report for the year ended 30.6.1999 the Bank reports that: "By end June 1999, there were 1,350 domestic and foreign investments worth more than USD 360.0 million, licensed to undertake mining and mineral activities in the country...." (BOT web site)

This development is also reflected in official UN statistics. A recently issued UNCTAD publication on Foreign Direct Investments (FDI) in Africa (UNCTAD (1999a)) shows that Tanzania has recently become one of the continent's more prominent recipients of FDI funds. Thus, Tanzania's average inflow of such funds amounted to 100 US$'mill. per year during the period1993-97 (versus 4 during 1988-92 and 0 during 1983-87). A faire share of these funds is presumably directed towards the mining sector.

Representatives of the international mining community are also on record with optimistic assessments of Tanzania's mining potential. In a recently published paper Dr Martineau, president of SAMEX mining company, states that: "The Kukuluma deposit is one of several discoveries in Tanzania which is likely to catapult Tanzania to second place in the league of Sub-Sharan African producers. Its development, planned for the year 2000, will be assisted by the new mining and fiscal codes being introduced this year by the Tanzanian Government which set fair levels of mining taxation and which draw on the experience of more forward African countries." (Martineau (1997))

A South African information site on African affairs makes statements of a similar nature. It asserts that "Tanzania is a key exploration area in Africa.....with 20 million ounces[3] of gold having been discovered in Tanzania in recent years." (MBendi TzMine) The same source states that "The World Bank offers insurance cover for foreign investments in Tanzania. These measures have all assisted in attracting exploration capital to the country. Annual investments in mineral exploration has increased from $US 0.5 million less than 10 years ago to $US 150 million."

In conclusion we consequently accept the argument that there exist convincing evidence in support of the hopes for a better future for the Tanzanian mining industry, and especially for the gold mining one. What remains to be done, then, is to translate these general expectations into

[3] Corresponding to 567 metric tons.

tangible numbers; i.e. into the type of concrete forecasts that are required for economic planning and analysis (via the Macmod model).

3 : Towards concrete forecasts

3,1: Searching for concrete project data

The present effort did not have the benefit of relevant, project-specific data supplied by the international mining companies concerned, or by the Tanzanian authorities. Instead we had to make do with whatever information could be secured from open sources. A search for data was conducted through the Internet. This resulted in the following "introductory" information:

- The BOT "Annual Report for the year ended 30.6.1999" identifies the following main mining companies active in Tanzania:

  By end June 1999, there were 1,350 domestic and foreign investments worth more than USD 360.0 million, licensed to undertake mining and mineral activities in the country. They include Ashanti Goldfields of Ghana, Anglo-American of South Africa, Resolute/Samax Resources of the United Kingdom and Sutton Resources of Canada. Resolute/Samax Resources project started production in November 1998. (BOT web site)

- In a 1998-interview with the South African newspaper Business Day the Tanzanian Deputy Mining Minister stated that:

  Tanzania's first operational gold mine since independence from Britain in 1961 is expected to be a $50m joint venture between Australian company Resolute Mining and its British partner, Samax Resources, at their prospect on the booming Lake Victoria gold field. Production is expected to begin before December. Kahama Mining, a subsidiary of Canada's Sutton Resources, plans to start production nearby in 1999, and has invested $135m in mine development. Others to start production by 2000 include Australian-owned Africa Mashariki (East Africa Gold) which has invested $75m in property at Tarime. Ghana's Ashanti Goldfields has invested $100m in its prospect. SA's Randgold Resources has a 1,5-million ounce resource base at Shinyanga, while Australian mining giant BHP Minerals is searching for base metals in Tanzania's far western Kigoma region. In the same region, Anglo American is on the prowl for nickel, cobalt, copper and base metals.(Dodd (1998))

- The South African Department of Finance has published some information on Foreign Direct Investment in SADC countries, naming the following companies and mines:

  Foreign direct investment into Tanzania has increased substantially over the past two years. Most of the foreign direct investment into Tanzania flows into the mining and exploration sector - during 1997, Tanzania received investments to the value of USD300m in mining and exploration. The companies involved have included Sutton Resources (Bulyanhulu), Pangea Goldfields of Canada and Randgold of South Africa (Golden Ridge in Sukumaland), and Resolute of Australia and Samax Resources of Britain (Golden Pride on Lake Victoria). (SADepFin/SADC web-site)

The three sources of information are consequently not in full agreement; they specify somewhat different lists of companies involved in mining in Tanzania. In total, we get the following list of companies:

- Africa Mashariki (East Africa Gold)
- Anglo-American
- Ashanti Goldfields
- BHP Minerals
- Pangea Goldfields
- Randgold Resources
- Resolute Mining
- Samax Resources
- Sutton Resources

An Internet search was made to obtain concrete information about the of investment projects of these companies (and of the additional companies Spinifex[4], Iscor and JCI (Johannesburg Consolidated Ind.), which were subsequently identified.) The effort meet with little success; few of the companies in question appear to have publicised anything in the way of concrete project-relevant web information of the kind required for our present purpose.

Some information was nevertheless secured through this effort. Thus:

- Pangea describes the Tanzanian mining scene as follows:[5] "In the next several years, over US$500[6] million will be invested in Tanzanian gold mining ventures and five gold mines are expected to come into production. These Tanzanian projects comprise the Golden Pride deposit (2.7 million ounces), the Bulyanhulu deposit (8.8 million ounces), the Geita Complex 12 million ounces), the Golden Ridge deposit (1.6 million ounces), the North Mara deposit 2.0 million ounces) and the Kahama deposit (1.8 million ounces)." (Pangea web-site)
- Resolute web-site describes the company's own operation as follows:[7] "Resolute acquired 50% of the Golden Pride deposit from Samax Gold Inc late in 1996..... Late in 1998 Ashanti Goldfields Company Limited acquired Samax Gold Inc, and with it, 50% of the Golden Pride Gold Project. In July 1999, Resolute agreed to acquire the remaining 50% of the project from Ashanti. Construction of the project commenced in November 1997. ....the project was completed on budget (US$48million) and first gold was poured on 10 November 1998. The Golden Pride mine is expected to produce an average of 180,000 ounces of gold per annum at a cash cost of US$200/oz." (Resolute web-site)

Additional data on the foreign involvement in Tanzania's mining sector was obtained from a commercial South African data bank: BusinessMap SA. The information is summarised in table 3,1.

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[4] Spinifex is probably the same company as the above mentioned Africa Mashariki (East Africa Gold).

[5] The text refers to total gold mining in general, not only to Pangea's part in it.

[6] The corresponding figure given in Pangea's Annual Report for 1998 is 360. Unfortunately, we have not been able to establish whether the estimate of 500 reflects a misprint or more up-to-date information.

[7] This quote may also serve to illustrate a specific problem encountered when investigating the Tanzanian mining ventures. It appears that a number of projects have had their ownership arrangement etc changed over time. As a result, it becomes quite difficult to trace them correctly through the information flow.

Table 3,1 : Foreign interest in Tanzanian mining ventures

Data record No.	Source Company	Target company	Status [8]	Invest-ments USD'mill.	Invest-ment period
1	Spinifex Gold (Australia)	Buckreef [9]	Expression of interest	0	1998
2	Sutton Resources (Canada)	Bulyanhulu	Expression of interest	0	1998
3	Resolute Ltd & Samex Gold (Australia)	Golden Pride Mines	New Invest-ment	47	1997
4	Anglo-American Corp. (RSA), Sutton Resources (Canada)	Kabanga Nickel-Cobalt-Sulphide Project	Expression of interest	0	1998
5	Spinifex Gold (Australia)	Kitongo	Expression of interest	0	1998
6	Anglo-American Corp. (RSA), Sutton Resources (Canada)	Nickel-Cobalt Project	Intention	108+27 =135	1997
7	Spinifex Gold (Australia)	Nyakafuru	Expression of interest	0	1998
8	Iscor (RSA)	Pangea Goldfields (Tz)	Expression of interest	0.83	1996-98
9	Randgold Resources (RSA)	Pangea Goldfields, Golden Ridge Mine Project	New Invest-ment	1	1995-98
10	Johannesburg Consolidated Ind (RSA)	Tanzanian Prospects	Expression of interest	0	1996
11 *)	Sutton Resources (Canada)	Various mines	Expression of interest	350	1998-2000
12 *)	Ashanti Goldfields Corp. (Ghana)	Various mines	Expression of interest	350	1998-2000
13 *)	Resolute/Samex Resources (UK)	Various mines	Expression of interest	350	1998-2000

Source: BusinessMap SA

**) Note to data record 11-13:* These records also state the that four international gold mining companies in question (Samex, Sutton, Ashanti and Anglo-American) are expected to invest $360 millions during the period 1998-2000. The companies plan to operate at Geita in Mwanza; Kahama in Shinyanga; and Nzega in Tabora. The companies began operations in 1992-94; the projects are now at advanced stage. Samax would start producing gold between October-December 1998; Sutton, operating under name Kahama Mining Corp, plans to start production late 1999. Ashanti and Anglo are to start production in 1999 or 2000. The four companies are expected to produce 25t worth $250m per year, by the year 2000.

The records of table 3,1 are seen to leave out some of the mining companies mentioned earlier. This may possibly reflect changes in ownership, name or similar, but the main reason is probably that the table does not give a full coverage of all tentative mining ventures in Tanzania. Thus, it seems likely that all already-decided projects are covered, and most of the relatively-soon-to-be-decided ones, while the further-into-the-future ones (i.e. those still under preliminary investigation) are largely ignored.

The Mbendi web site (MBendi TzMine) tends to corroborate the list of companies given above. It names quite a few companies that have demonstrated an interest in Tanzanian mining ventures,

[8] It is a little unclear exactly what "Expression of interest" implies. It is assumed that the company in question has stated its intention to undertake concrete investigation of given mineral sites.

[9] This appears to be the former state-owned and -operated Buckreef mine. It is recalled that this mine was closed down in 1990, closing the book on "commercial" gold mining in Tanzania (before recent events). It appears that the mine may now possibly be reopened under new management and ownership arrangements.

including one or two not mentioned by other sources.[10] It does not, however, provide much concrete data directly applicable to our present needs (i.e. project specific information about investment and production variables). Even so, it does give the following additional information:

- *Nickel Cobalt Mining*: Sutton Resources and BHP Minerals are investigating the prospects of potentially rich cobalt and nickel deposits at Kagera in Tanzania.

- *Diamond mining:* In 1994 De Beers increased its stake to 75% of the equity of Williamson Diamond Mines as part of the government's privatisation initiative. Operations were suspended and the mine rehabilitated as a small mine. The mine resumed operation in 1996. A further development was completed in 1997. Regrettably the high-grade diamond rich gravel is almost depleted. The most one can hope for is that the operation repays its US$16 million loan in the agreed five year and that it operates with sufficient efficiency to produce some return in the following two or three years.

- *Coal mining:* China will supply equipment for the rehabilitation of the Kiwira coal mine. This will permit an annual production of 150 000 tons. USD 2 million will be spent on a power unit, heating unit, turbines and a mineral treatment plant.

3,2: Analysing the available data

3,2,1: Information overlap

The concrete interpretation and aggregation of the above information is not an altogether straightforward task. The data of table 3,1 are the more concrete, comprehensive and relevant to our task, but even so they are *far* from flawless. Thus, they serve to illustrate the existence of foreign companies' "expressions of interest" in Tanzanian mining ventures, but they do not, on the whole, provide much concrete data about likely investment and production values.

There is also a definite risk of information overlap, i.e. that some projects/investments are covered by more than one data record. This is for instance the case for record no. 11-13, all of which refer to an investment of UD$ 350 million into "various mines". Obviously, these records all refer to the *same* investment-aggregate, not to three different aggregates each of this magnitude.

Moreover, it appears that part of the UD$ 350 million investment is specified also among record no.: 1-10, i.e. that the latter overlap with record no.: 11-13. Thus: the Resolute/Samex investments recorded under data record 3 are evidently part of the "joint" investment total recorded under record 13. This is reasonably clear from the Martineau (1997) paper which states that Samex is developing the following two gold mines in Tanzania:

- Golden Price, which is covered by record 3[11] (and by record 13);
- Kukuluma, which appears uncovered by any of records 1-10.[12]

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[10] This is possibly because the companies in question are known under alternative names, or because they are fairly marginal actors on the Tanzanian scene, (for instance co-financing preliminary prospecting activities).

[11] A comparison of specifics given for the Golden Pride mine in (Martineau (1997)) and the footnote to record 13 makes it clear that we are dealing with the same mine. Thus, both sources state that Samax would start production at this mine between October-December 1998.

Other possible cases of overlapping concern data records 2 and 11[13] (where, to be true, record 2 does not specify any investment sum), and data records 4 and 6.[14] There may well be more cases of double counting, but we are unable to pin them down. Fortunately, our failure to detect all such cases does not really matter because record no. 3 is in reality the only record of any genuine concern (among record no.: 1-10).

This is because data records 11-13 deal with *gold* mining *only*, while record 3 is alone (among 1-10) in specifying substantial investments into gold mining. True, record 6 does specify an even larger investment, but *not* into gold mining. Records 8 and 9, on the other hand, which do specify investment into gold mining, are both rather insignificant in size. The rest of the records do not specify any concrete investment estimates at all, indicating instead that a potential interest has been indicated for doing so later (subject to future investigation, prospecting etc.)

Translating such indications of interest into concrete estimates, representing future production volumes, is no easy matter. In most cases we has no alternative but to rely on fairly loose guesses and unsubstantiated presumptions. This is also true in the present case. Given this state of affairs, the potential problem arising as a result of undetected double counting seems minute. We will therefore move on to the question of investment fallout without further deliberations in respect of double counting.

3,2,2: Investment fallout

The data of table 3,1 do not specify the dates to which the information refers. We do not know when the information was collected, or whether it has recently been updated or reaffirmed. In consequence, we cannot be entirely certain that the information given about the various investment projects are quite up to date. This may be a bit of a worry, given the possibility of cost overruns and implementation delays.

Nor do the data of table 3,1 specify the date of decision making, i.e. it does not specify the data on which the investing company decided to go ahead with a given project, as "described" in table 3,1. We can therefore not be sure that the various "expressions of interest" registered in table 3,1 still remains valid. The possibility exists that they reflect "fundamentals" that have since wors-

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[12] The possibility exists that it may also be uncovered by record 13. However, Martineau states that the Kukuluma mine is situated at Geita in Mwanza, which is one of the locations specified in the footnote to record 13. The Kukuluma/Geita project consequently appears to be one of the "various mines" covered by record 13.

[13] Thus, the footnote to record 11 states that: "Sutton, operating under name Kahama Mining Corp, plans to start production late 1999." From Mbendi TzMine we learn that: "Kahama Mining, a fully owned subsidiary of Sutton Resources of Canada, is operator on Bulyanhulu in the Lake Victoria Goldfields, which starts production in early 1999 with a target of 300,000 oz. per annum." Applying this information to record 2, where Sutton Resources is specified as the source company and Bulyanhulu as the target, it is evident that records 2 and 11 overlap.

[14] In the latter case, however, it seems more likely that although both data records refer to the same mine, they refer to different stages of mine expansion. Thus, the Mbendi web-site provides the following information about this project: Anglo American acquired a majority stake in Kabanga Nickel Company, which holds the rights to the Kabanga Nickel Cobalt Project, from Canadian company Sutton Resources. Anglo American expects to contribute $27 million towards the development of Kabanga commencing with a programme of *additional exploration drilling* to be completed by 2001. (NB: It may be noted that the said US$ 27 million may represent prospecting finance rather than investments into processing capacity as such.)

ened significantly. An attempt should be made to assess this risk, focused on the sales-price of the metal concerned (this presumably being one of the key "fundamentals").

Table 3,2 : World market price for gold, nickel & cobalt [15] [16]

Period	Gold		Nickel		Cobalt		NC-comp.[17]	
	Price	Index	Price	Index	Price	Index	Price	Index
1990	384	99	402	118				
1991	362	93	370	109				
1992	343	88	318	94				
1993	360	99	241	71	15	63	36	63
1994	384	99	288	85	23	96	54	95
1995	384	99	373	110	29	121	68	120
1996	388	100	340	100	24	100	57	100
1997	331	88	314	92	24	100	57	99
1998	294	76	210	62	18	75	42	74
1999	279	72	273	80	15	64	36	64
2000 (Jan-Jun)	285	74	427	126				

Sources: Various, see footnote.

Table 3,2 depicts the movements of the gold price during the 1990s. The table shows that the price of gold remained fairly stable, and high, prior to 1997. During the mid-1990s the price was approx. 380-390 US$ per ounce. It subsequently fell to around 280 US$ per ounce in 1999, taking more than a quarter off the mid-1990s price.

A reduction in the gold price of this magnitude will presumably have negative implications for the prospective investor's interest in investing in gold mining, and especially so if the depressed price is expected to remain in force for an extended period. In the present case there may be reasons to fear that the gold price may remain depressed for quite some time. Thus, the IMF and a number of central banks, presently holding huge gold reserves, have indicated their intention to sell off significant amounts of gold. It may therefore be a real possibility that the information given in table 3,1 about gold mining interests are too optimistic given today's price realities.[18]

Looking a little further into this matter we return to the data of table 3,1. Although they do not specify the date of the underlying business decision, they do give the so called "investment year" (and sometimes the "investment period"). The investment year given by the various records of table 3,1 all fall within the period of 1995-98, and most fall within the period of 1997-98. Pre-

[15] The price for gold refers to US$ per ounce, for nickel US$ per metric ton, for cobalt US$ per pound, and for the NC-composite US$ per kg. All indexes use the 1996 price as base.

[16] The prices for gold and nickel for 1990-98 are from IMF's IFS series. The corresponding prices for 1999-2000 are based on data from World Bank Pinksheets. The price data for cobalt for 1993-98 are crude approximations, based on (UNCTAD (1999)). The corresponding estimate for 1998 is based on data from the London Metal Exchange (http://nickelaloy.com).

[17] Nickel-Cobalt-composite, calculated by first translating the nickel and cobalt prices into kilo-term, and next calculating the price of a "composite product" consisting of 12.5 kg of nickel and 1.0 kg of cobalt. The background for these calculations is explained in the main text.

[18] Thus: "The Tanzanian Chamber of Mines cautioned last year that the sector could be hurt if the gold price continued to fall below $300/oz." (Dodd (1998)).

sumably, these are the periods during which relevant physical activities are likely to be undertaken. I.e. the period in which:

- geological surveying and prospecting is supposed to be carried out in the case of the tentatively interested ones;
- land clearing and site construction is supposed to be carried out in the case of actually committed investors.

If so, the initial decision to enter into these activities must have been made quite a while earlier, for instance during the period 1995/96-96/97. This means, *inter alia*, that these decisions may have been "flavoured" by the relatively high and stable gold price prevailing until 1996. If this is indeed the case, the later fall in the gold price may possibly have dampened the enthusiasm of some prospective investors. One may therefore suspect that some of the professed "expressions of interest" will fail to result in investments.[19]

It should be emphasised that the above argument relates to *prospective* investors, i.e. to investors that are still free to withdraw from the proposed project. The case is very different for investors that have already committed their funds in Tanzania. They are in many ways "captured" by their action, their funds having already been "sunk into the local ground". A price fall may mean that they fail to earn a proper return on their investments, but even so they may be relied on to stay in business as long as the price covers their recurrent operations costs. In all probability, the gold prices quoted in table 3,2 are all well above this level.[20]

Moreover, it appears that the major gold investors may already have adjusted their price expectations to the present relatively low level without stopping the project. Thus, it is recalled from table 3,1 that the four companies in question "are expected to produce 25t worth $250m per year, by the year 2000." Taking this to mean that the companies expect to produce 25 *metric* tons worth 250 million *US*$ per year, and using the conversion factor: 1 ounce = 28,35 gram, we find that the implied sales price is 283,50 US$ per ounce. This price is in line with the latest price quoted in table 3,2. We will therefore assume that no major "investment fallout" has occurred.

Table 3,2 also depicts the movements of the nickel and cobalt prices. These are introduced in order to help assess the viability of the two nickel-cobalt projects specified in table 3,1. An assessment of these projects will necessarily be crude, given that the nickel-cobalt mix of the mine-product is unknown to us. However, it may be noted that the original BusinessMap information about record no. 4 contained a footnote stating that preliminary resource calculations for a potential future nickel-cobalt mine indicates a nickel grading of 1.5-2.4% and a cobalt grading of 0.11-0.18%. If this is representative also of the other mine (record no. 6) we are consequently dealing with a "predominant" nickel-producer as seen in terms of *volume*, generating some 10-15 kg of nickel for each kg of cobalt.[21]

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[19] I.e. that fewer investment projects will materialise than would otherwise have been the case. It is difficult to judge how much of a problem this may be; much will depend on the investors expectations and strategy. Some investors may have the luck to discover low cost/high yielding mines that will make a profit despite low gold prices. Also, foreign mining companies may look further ahead, hoping for better times in a few years' time, and deciding to get established in Tanzania "ahead of the others".

[20] Thus, Martineau (1997) states that the operating costs of the Golden Pride mine will be *below* 200 US$ per ounce.

[21] A ratio of 12.5 to 1 is used in the calculation of the composite nickel-cobalt price given in table 3,2.

However, we know from table 3,2 that cobalt earns a much higher price than nickel. Thus, the 1996 (index base year) price of nickel was 340 US$ per ton, i.e. 0.34 US$ per kg, while the price of cobalt was 24 US$ per pound, corresponding to approx. 53 US$ per kg. The mine would consequently earn around 150 times more from the sale of one kilo of cobalt, than it would from the sale of a kilo of nickel. If this is accepted as representative of the impending mine (see record 6) we are consequently dealing with a "predominant" cobalt-producer as seen in terms of *price* and revenue.

The composite estimates indicate that the average nickel-cobalt price fell significantly after the mid-1990s, from an index value of 100 in 1996 to 64 in 1999. However, the estimates also suggest that the price grew significantly prior to 1995-96. All told, the price has probably fluctuated considerably over the years, more so than for gold. The investors in question will presumably have taken this market characteristic into account before reaching their decision. Despite the very significant price fall recorded for 1999 we will therefore assume no major "investment fallout" also in this case.[22]

3,2,3: Guestimates

The hard facts at hand are too few to allow us to produce proper predictions depicting the development of the Tanzanian mining industry during the years ahead. Despite major investment activities already in progress much still depends upon project decisions that has not yet been made, or implemented. Instead we shall have to make do with guestimates, serving as tentative illustrations of these developments. The guestimates in question are detailed in table 3,3.

The guestimates of table 3,3 are based on what the present author considers a likely interpretation of the available information. Other analysts may see these things differently, and wish to revise the present estimates. Moreover, all guestimates are by their very nature subject to considerable doubt and uncertainty. It is only to be expected that they may be subject to significant revisions as soon as new, more or better information becomes available.

In order to facilitate such revisions we shall specify the information and assumptions behind the present guestimates in considerable detail. This is done in the following, where the various components of the overall mining complex are discussed under five different headings.

A: Present (foreign) investments into gold mining

Various sources of information agree that a group of some 4-5 foreign mining companies are at present actively engaged in developing a range of gold mines in Tanzania. The total investments involved appear to be in the region of US$ 360 mill. The exact number and identify of the companies and mines involved is less clear, because the available information is a little confusing.[23] We will therefore treat them as a whole, without trying to identify the individual units.

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[22] It may also be noted that the nickel price made a brisk recovery during the first half of year 2000, suggesting that base metal prices may possibly be on the mend at the moment.

[23] This may possibly result from a tendency for widespread cross-ownership and frequent changes of ownership among the companies involved.

Table 3,3 : Guestimates for the mining sector [24] *(US$'mill at constant 1998 prices)*

A: Total annual production									
A,1: Gross Output (GO)									
		Period:							
New/foreign ventures:	Ref.:	*1998*	*1999*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*
- in gold mining	A	3	27	77	175	241	259	259	259
- in Ni-Co-mining	B	15	37	55	55	55	55	55	55
- in future mining	D	0	0	0	16	31	47	63	79
Total foreign		18	63	132	246	328	361	377	393
Local mining	E	119	125	131	138	144	150	157	163
Overall total		138	188	263	383	472	512	534	556
A,2: Value Added (GDP)									
		Period:							
New/foreign ventures:	Ref.:	*1998*	*1999*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*
- in gold mining	A	2	19	54	123	169	181	181	181
- in Ni-Co-mining	B	10	26	39	39	39	39	39	39
- in future mining	D	0	0	0	11	22	33	44	55
Total foreign		12	44	92	172	229	253	264	275
Local mining	E	100	105	110	116	121	126	131	137
Overall total [25]		112	149	202	288	350	379	395	412
B: Total annual investments									
Gross Capital Formation									
		Period:							
New/foreign ventures:	Ref.:	*Pre 99*	*1999*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*
- in gold mining	A	80	150	120	0	0	0	0	0
- in Ni-Co-mining	B	110	9	9	9	0	0	0	0
- in future mining	D	0	0	27	27	27	27	27	27
Total foreign		190	159	156	36	27	27	27	27
Local mining	E		3	3	3	3	3	3	3
Overall total			162	160	40	31	31	31	31

The pertinent facts and assumptions concerning the investment projects of the group are as follows (ref.: records 11-13 of table 3,1):

- The investment period quoted for these mines is 1998-2000. We accept this as the time horizon for the main investment activities as such. The corresponding mining activities are presumed to follow gradually, reaching their full capacity in year 2003.
- The combined investment cost for these projects is estimated at US$ 360 mill. This total is presumably measured in expected 1998-2000 prices. We will assume that the corresponding total measured in constant 1998 prices is around US$ 350 mill.
- The total volume of production expected from these mines (after year 2000) is 25 tons per year, at an estimated value of US$ 250 mill. per year. The implied gold price is consequently 283.5 US$ per ounce. This is slightly below the actual 1998 price of 294 US$ per ounce (see

[24] Note that these "estimates" do not claim to represent the "absolute truth" about future mining developments in Tanzania. Rather, they are offered as a tentative illustration of these developments.

[25] The estimate of 112 for 1998 is adopted from table 4,1.

table 3,2). Converting the estimate into 1998 prices, we get a production (Gross Output) estimate of US$ 259 mill. per year.

- The corresponding GDP estimate is US$ 169 mill. per year. This is calculated from the above Gross Output estimate on the assumption that the GDP/GO ratio is 0.7.[26]
- Golden Pride is the first mine to come into operation. Investments started in 1997. Total investment costs are quoted at US$ 47 mill., presumably measured at current prices. The corresponding total measured in 1998 prices is probably US$ 48 mill.
- Golden Pride is supposed to be operative from late 1998. The expected production is 180,000 ounces of gold per year. The value of production at 1998 gold prices is US$ 53 mill.
- The implied Capital Output Ratio is approx. 0.9 for the Golden Pride mine, and approx. 1.5 for the rest of the group.[27] We will use the latter as a "guide" towards the construction of estimates also for mines outside this group.

B: Present (foreign) investment into Nickel-Cobalt mining

Anglo-American and Sutton Resources are reported to have made investments into a nickel-cobalt mine. The pertinent facts about this venture are as follows (ref.: record 6 of table 3,1):

- The investment period is quoted as 1997 and the investment costs as US$ 108 mill. The latter is presumably measured at current prices. The corresponding total measured in 1998 prices is probably around US$ 110 mill.
- In addition a further US$ 27 mill. are spent on additional exploration drilling. It is assumed that the corresponding 1998 value is of the same magnitude, and that it is spent fairly evenly over the period 1998-2001.
- The expected production (Gross Output) value is not specified in our data source. We will employ a crude "guestimate" of US$ 55 million, based on an assumed Capital Output Ratio of 2.0.[28]
- The corresponding GDP estimate is US$ 36 mill. This is calculated from the above Gross Output estimate on the assumption that the GDP/GO ratio is 0.7 (as in the above case).
- The start of actual mine production is not disclosed by our information. All we know is that the investment activities were supposed to start in 1997, (and possibly also that they were supposed to be completed within the same year). We will assume that some production activity may have been initiated already in 1998 (and that this initial production may in fact have contributed to the steep rise in mining GDP recorded for 1998 in table 2,1). We further guess that full production capacity may be achieved by year 2000.

C: Investments into Pangea Goldfields

The South African companies Iscor and Randgold Resources are reported to have invested a total of US$ 1.8 mill. in the Pangea Goldfields (ref.: records 8 and 9 of table 3,1). It may be noted that

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[26] The GDP/GO ratio of 0.7 is based on a handful of corresponding coefficients, representing large-scale mining operations in a few other African countries.

[27] The Capital Output Ratio measures the ratio between the capital invested into a new venture, and the resulting annual production-increase. In the present case this ratio is: 48/53 = 0.9 for the Golden Pride mine, and ((350-48)/(259-53)) = 1.5 for the rest of the group.

[28] The ratio of 2.0 is highly tentative. It corresponds to the "benchmark" ratio of 1.5 (see section A), as adjusted for a 25% price-slump factor (1.5/(1-0.25) = 2.0). The price-slump factor represents the implied 1998 "under-pricing" of nickel-cobalt (as compared to the 1996-level, when the original investment decision was (presumably) made).

Pangea is not listed among the "source companies" of table 3,1, rather it appears as a "target mine". In actual fact, however, Pangea is not a mine as such but a mining *company* (i.e. it is a source company according to the classification of table 3,1). In all probability, therefore, the funds in question represent "portfolio" investments in part-ownership in already existing Pangea-activities (as opposed to "real" investments in additional production capacity). We will therefore ignore these investment funds, presuming their "real-term counterpart" to be covered by project included in section D below.

D: Other potential (foreign) investments

According to the information available it seems clear that interested companies are presently examining a number of potential mining projects. Whether or not they will in fact go ahead with them is still an open question. Presumably, much will depend on further examination (test-drilling etc) of the sites in question. It is consequently impossible, at this stage, to make any informed estimates in respect of the number and character of mining projects materialising from these deliberations.

When studying scenarios involving such "unknowns" one may sometimes avoid the problem by leaving the unknown variable out of the analysis. This produces a "partial/minimum" analysis of sorts, which may often prove acceptable. In the present case, however, we are trying to guess at the *full* rather than the *minimum* extent of mining expansion in Tanzania. It would be inappropriate to leave any relevant element out of such an analysis, even if we should fail to have all the required information readily at hand.

Even though the concrete outcome of still ongoing deliberations must necessarily remain in doubt, it seems realistic to expect that some of them will result in new mine investments. The mere fact that numerous mining ventures (according to table 3,1 etc) are under active consideration does in itself serve to indicate the likelihood of such a development.

Moreover, the records of interest made in table 3,1 etc only cover sites for which preliminary studies or similar are known to have been made. But the prospects for future mine developments ought to be significantly larger than those presently investigated. Tanzania is in many respect "virgin territory", possessing numerous potential mining sites, many of which have not yet been properly examined. Presumably, the international mining sector will participate in the examination of these sites.

The case of Pangea Goldfields may serve to illustrate the point. In Pangea's 1998 Annual Report it states that: "Pangea's Lake Victoria Goldfields properties total an area of approximately 2,900 square kilometers of mineral claims....These interests are held in 36 mineral concessions, two of which are wholly owned by Pangea Minerals Limited ... and 34 of which are held under joint-venture agreements..." (Pangean web-site) Pangea alone has consequently secured a total 36 mining rights, a number far in excess of the few projects recorded above in table 3,1 etc. In all probability, Tanzania's long-term mining potential is therefore considerably larger than revealed by those data.

The relevant question is consequently not so much *if* new mines[29] will come on stream, but how many, when and where. We do not claim to have the answer to these questions. In table 3,3 we have instead "solved" the problem by allowing the as yet unidentified mines of the years ahead to be represented by a set of purely nominal figures. In the absence of concrete data for the projects that are presently under active consideration, we have chosen to adopt the assumption that the mines in question will increase the total production (GO and GDP) in the "foreign" mining sector by 25% by the end of year 2005.

Or expressed differently: we will assume that as yet uninitiated mining operations will, by the end of year 2005, produce ¼ of the production expected from the mines already under construction, i.e. from the mines discussed under sections A and B above. The corresponding investment requirements are calculated on the assumption that the Capital Output Ratio is 1.75.[30]

The investments and production volumes thus calculated are introduced in a gradual and evenly phased way in table 3,3. This trend-representation is a mere convenience. Thus, it may well be argued that such a smooth trend must be an incorrect way of presenting developments that will arise in the form of "lumpy" and discrete events. In response we can but re-emphasise that these results are not meant to provide proper predictions of actual events, but merely to illustrate likely or possible trend developments.

E: Local mining

The above discussed investment projects concern the activity of foreign companies. In this section we shift the focus to Tanzania's own mining activities, i.e. artisanal gold mining etc. These activities are quite diverse in nature, but relatively small in value (compared to the intended foreign ones). We will therefore allow ourselves to join them together and treat them as one. The combined sub-sector here discussed will consequently embrace mining for gold and other precious minerals, but also stone quarrying, coal and salt mining etc.

It is recalled from table 2,1 that the GDP statistics for the mining sector indicate that the sector grew rapidly throughout the 1990s (see table 2,1). Except for the last year or two of the period this growth may be attributed to local mining alone. Local mining, therefore, appears to have grown by roughly 10 % pa (in constant price GDP terms), an impressive rate by most standards.

This rate, however, is probably a bit "deceptive". It probably *does* reflect the real expansion of mine output in response to the new policies introduced by the Tanzanian authorities. But it probably *also* reflects the increasing "legalisation" of already existing operations in response to these policies. Presumably, developments will soon enter into a new and more "settled" phase, which may be characterised by growth rates more modest in magnitude, but also more genuine in nature.

Following this line of argument we presume the local mining industry to remain capable of significant growth also in the years ahead, but *not* to outgrow the rest of the economy to the same

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[29] I.e. mines additional to those discussed under earlier headings.

[30] Note that we assume a Capital Output Ratio of 1.75, rather than the corresponding ratio of 1.5 applicable to the "big four". This reflects the possibility that future mining ventures may have to make do with mineral deposits slightly poorer than those of the "big four".

extent as it did during the 1990s. The GDP estimates for local mining employed in table 3,3 are based on an assumed 5,0% pa real-term growth rate for year 1999 and 2000, subsequently reduced (evenly) to 4.0% pa by year 2005.[31] The corresponding Gross Output estimates are calculated employing a GDP/GO ratio of 0.84[32], while the corresponding investment requirements are calculated using a Capital Output Ratio of 0.5. The latter reflects the assumption that this kind of mining is very low in capital insensitivity.

4 : Concluding remarks

Before ending this paper it may be useful to make a few brief references to some related topics. The first concerns the question of how the mining guestimates translate into percentage contributions to the nation's overall GDP, while the second concerns the issue of supplementary activities.

4,1: Contribution to overall GDP

It is recalled from the above that the Tanzanian mining sector is expected by many to "take off" in the years ahead. The Tanzanian authorities have consequently set their hopes on the sector in their quest for economic development. Mining is counted on to contribute a rapidly growing share of the nation's overall GDP. Thus, a government official is even on record suggesting that the mining sector may account for as much as 10-15% of national GDP by year 2003. Given present realities, this seems quite unachievable. The guestimates of table 4,1 instead suggest that mining may contribute around 4% of overall GDP in that year.

Table 4,1 : The growth of mining GDP in total GDP (US$'mill., at constant 1998 prices)

	1998[33]	*1999*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*
A: Mining[34]	112	146	196	275	334	361	377	392
B: Other[35]	7 595	7 899	8 215	8 544	8 886	9 241	9 611	9 995
C: Total	112	146	196	275	334	361	377	392
A in % of C	1,5 %	1,8 %	2,3 %	3,1 %	3,6 %	3,8 %	3,8 %	3,8 %

To be fair, the said suggestion was made some years ago (in April 1998, before investment activities had started in earnest), and it probably was offered more as a hope than as a forecast. Even so, it may serve as a warning, reminding us that it is all too easy to become euphoric when dealing with potential "windfall projects". Experience show that even promising prospecting results do not necessarily guarantee a speedy success.

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[31] This growth trend reflects the above "maturity" argument, but also the assumption that growth in Tanzania's economy as a whole will pick up. In response, less occasional labour will "seek refuge" in artisanal mining. It also reflects the presumption that *some* of the country's artisanal gold mines may be hurt by the entry of the international mining companies. Nevertheless, the majority of local mining activities are *not* presumed to be hurt.

[32] The GDP/GO ratio of 0.84 is adopted from the latest Input/Output table for Tanzania. It represents the average for the whole mining industry (as seen from table 4,2).

[33] Based on TZS estimates from table 2,2, and an average TZS/US$ exchange rate of 665.

[34] Guestimates (for 1999-2005) from table 3,3.

[35] Guestimates (for 1999-2005) are based on the assumption that Other GDP grows by 4.0% pa (in real terms).

4,2: Supplementary activities

An expansion of the mining sector along the lines suggested above may generate a number of other activities, of a "supplementary" nature. These should not be ignored, *if* our concern is to forecast the economic growth resulting from the developments in the mining sector, (as opposed to focusing exclusively on developments within the mining sector itself, as narrowly defined). Some such activities are briefly discussed in the below:

- Prospecting
  - Investments into the construction of physical mining capacity do not normally represent the first activity undertaken for a new mining venture. The investment phase must in most cases be preceded by a prospecting phase, the cost of which may be very considerable. These costs represent economic production activities. Even so, such production does not necessarily add much to the overall GDP of the country concerned. This will depend on the "local content" of these activities; i.e. of the nationality status (local or foreign) of the companies producing the prospecting services, and the employment of local resources.
  - The bulk of the prospecting services undertaken in Tanzania in the next few years will probably be undertaken by and for foreign mining companies. If so, they will not furnish too much of a direct/immediate contribution to Tanzania's total GDP. Instead, they will typically represent services imported to, and subsequently "re-exported" from, Tanzania.

- Construction
  - Total investment costs may be broken down and grouped in various ways. In the present case we will focus on the following broad cost categories:
    1. construction work (earth-moving, construction of buildings, roads etc.)
    2. machinery and equipment (excavators, crushers, dumpers, smelters etc.)
  - Locally produced machinery and equipment for the kind of mining projects envisaged is unlikely to be available in Tanzania. Such cost components will consequently tend to translate fairly directly into commodity imports.
  - Construction works, on the other hand, will tend to generate demand directed at the local construction industry, i.e. it will generate local GDP. This is probably true even if a large share of these activities should happen to be undertaken by international construction companies, or by the foreign mining company itself.[36]

- Production inputs
  - A significant expansion of Tanzania's mine production implies a corresponding growth in the sector's demand for production inputs. This extra demand may be satisfied by increased supply of local goods and services, or by increased imports. In the former case the growth of the mining sector generates (direct) growth-impulses throughout the local economy; in the latter it does not.

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[36] Note that Standard National Account practise prescribe that the local production activities of a construction company or similar should be classified as local, even when the company concerned is 100% foreign. In other words: constructions can not be imported, only the services and equipment to build them.

- In order to make proper forecasts in respect of the full economic implications of a given mining project it is therefore essential to employ proper information on the corresponding input structure. This information may preferably be specified in terms of Input/Output (IO) data that can be fitted into the Tanzanian IO table.
- Tanzania is currently finalising the production of an economy-wide IO table. Thus, it should in principle be possible to undertake the kind on impact analysis mentioned above. Before doing so, however, the problem of data-validity must be resolved.
- The problem arises because the average input structure of the new mines is likely to be quite different from that of the existing ones. The former will tend to reflect fairly large-scale and capital intensive mining operations, while the latter covers small-scale and labour intensive ones. The present IO table, of course, only reflects the existing mine structure.
- The simple "pick and shovel" nature of the present industry suggests a fairly low reliance on intermediate inputs. The present IO table confirms this expectation. Thus, as seen from table 4,2 intermediate inputs do on average account for a mere 16% of Gross Output, out of which very little is imported. The new FDI driven mining ventures, in contrast, will typically require substantially more intermediates, of which much will be imported (for instance fuel and spares required to run mechanised operations).
- One may try to get a little closer to the future mining structure by focusing on the sector "other mining". As seen from table 4,2 (last column but one) this sector has an intermediate input ratio of 25%, almost all of which originate from domestic sources. Although probably closer to the "truth", even this seems unlikely to provide a correct picture of the input requirements of the future mining industry. An effort should therefore be made to obtain supplementary data in respect of the new input structures that will present themselves in the years ahead.[37]

Table 4,2 : The input-structure of the mining industry

	Stone, clay and sand	Salt	Gem-stones	Other mining and quarrying	Total mining and quarrying
Intermed. use – Domestic	18 %	20 %	11 %	24 %	14 %
Intermed. use – Imported	2 %	1 %	2 %	2 %	2 %
Intermed. use –Total	20 %	21 %	13 %	25 %	16 %
Total GDP (market price)	80 %	79 %	87 %	75 %	84 %
Gross Output	100 %	100 %	100 %	100 %	100 %

Source: Draft IO-table, provided by the Planning Commission.

[37] In the first instance one may try to obtain the relevant information from the companies concerned. If this fails (which it may well do) one may alternatively try to construct these data, employing Input/Output data or similar from a country with "reasonably similar" characteristics (in respect to the nature of Tanzania's upcoming mining structure.)

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