

Final Report

The Value of Gold for the Republic of Mali

Policy Analyses and Private Sector Strengthening



SUBMITTED TO
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ABSTRACT

Sustained international demand for gold has generated intense interest in and development of the gold mining sector in Mali. While the large-scale (or modern) sector has increased production markedly in the last ten years, resulting in real wealth gains for Mali, the magnitude of the sector's contribution to the economy has been overstated.

This study estimates the first- and second-order effects of mining on the economy by examining tax revenues, wages, and linkages to other sectors. The analysis includes an approximation of quasi-rents retained by Mali from gold production as a percentage of the value of exports. The results raise questions about prospects for long-term development emanating from the large-scale gold sector, especially given the recent stagnation of the world price of gold and the planned increases in production in Mali.

The analysis also suggests the need for further research on small-scale (informal sector) mining which holds significant promise for sustainable, long-term development of the Mali's gold reserves. Particularly in regions of the country where mining coexists with other economic activities such as livestock and agriculture, small-scale mining definitely has a widespread and positive impact on living standards for some parts of the local communities.

However, that positive impact remains limited to a fraction of the population, leaving a large majority in a precarious situation. Given the specific structure of small-scale traditional gold production, its mode of operation and ownership system, we see that its first- and second-order effects are limited and do not go beyond local linkages. Artisanal gold mining does not play a role at the regional or national level because some of the resources it generates are not invested. Therefore, small-scale traditional mining warrants both further research and more active policy attention from government.

The Value of Gold for the Republic of Mali

INTRODUCTION

From the era of the Ghana Empire to the present-day Republic of Mali, gold has always been extracted by populations of these regions, using techniques or technologies that we now call "traditional" or "artisanal". Until the mining code was formulated in 1970, and before SOGEMORK was created, gold production was artisanal. Large scale industrial exploitation of gold is relatively recent, even though earlier legislation existed (Law No.63 - 51/AN - RM of May 31, 1963, that was followed by three ordinances: No.34/CMLN of September 3, 1970; No.91 - 065/P - CTSP of September 19, 1991; and finally No.99 - 032/P - RM of August 19, 1999).

Production of gold in Mali more than doubled between 1995 and 2000. Interest in the sector is high on the part of foreign investors and Malians alike. While the investment community focuses on the profit potential from Malian gold resources, policy makers are as concerned with the impact on Mali's long-term development. The doubling of gold production did not come from the whole of the gold mining sector, but solely from the large-scale production subsector and its modern industries. Small-scale, artisanal mining is not included in official production statistics. However, a comprehensive analysis of the impact of gold production on long-term development must now include consideration of small-scale production as well.

This study of intersectoral integration within the gold mining sector is a response to a request from the Ministry of Industry, Trade and Transport in cooperation with the National Direction of Geology and Mines (DNGM) of the Ministry of Environment and Mining in the Republic of Mali. Much recent sectoral analysis has been accomplished. This report extends that analysis in new ways in response to questions of integration and long-term development.

This report begins with the important issue of gold in the world economy. It is followed by analyses of integration and the linkage effects in the large-scale gold production subsector (see annex for results of the model developed for the DNGM; this model estimates the user value of remaining gold reserves, as a function of marginal extraction cost, the world price of gold, and reserve variations). Finally, we analyze the current situation of the informal gold subsector.

THE WORLD GOLD ECONOMY

Gold is a source of income for both producers and consumers. Gold is now exchanged all over the world, which makes it difficult to make a clear distinction between consumer and producer; consumers' and producers' interests are interdependent, and they are a function of the price of gold, the pace of discovery and mining of ore deposits, technologies used for processing the ore, etc. In spite of that interdependence, there is competition among producers (producers in poor countries, companies, industrial groups), among consumers, and between both groups. The world gold economy is much broader than any single economy, since it involves at the same time large mining business groups, national states with exploitable reserves, and all kinds of gold buyers.

The International Gold Market

Gold has always been prized as a display of wealth and a store of value. Likely the first commodity traded globally, gold provided the economic base for the development of Africa's greatest kingdoms. Both the empire of Ghana (300 to 1240 A.D.) and the empire of Mali (750-1337 A.D.) thrived on the gold trade. On his famous pilgrimage to Mecca in 1324, the Malian emperor Kankou Moussa and his entourage carried with them gold bars that would be worth today more than \$100 million. Their arrival and expenditures in Cairo depressed the price of gold in Egypt for 12 years.¹ Today, total gold in existence above ground amounts to some 130,000 tons, 33,000 of which nation-states hold in the form of official reserves.² The rest lies in private hands.

Demand for gold has steadily increased since the last century and remains strong. Jewelry far outranks bars as a source of demand. In 1999 demand for jewelry totaled 2800 tons, whereas demand for gold investment was less than 20% of that, at 480 tons.³ Demand in 1999 surpassed that of 1998 by 21 percent, setting a new record. India far outstrips any other country in gold consumption, having purchased 839 tons destined for gold jewelry in 1999. The United States ranked second at 460 tons, and China third at 205 tons. A strengthening world economy has boosted gold demand in recent years, especially as Asian countries have recovered from the financial crisis of 1997. Exceptions to the trend of increased demand include the Middle East, where energy revenues have flagged in the last few years, and Europe, where sluggish growth and uncertainty about the euro have limited gold demand.⁴

Gold production has increased more than sevenfold over the past 150 years and has almost doubled since the early 1980s.⁵ Since 1980, the greatest increases have come in the United

¹ Basil Davidson, *African Civilization Revisited* (Trenton: African World Press, 1991).

² Penelope Plowden, Georgina Wilde, "A Glittering Future? Gold mining's importance to sub-Saharan Africa and Heavily Indebted Poor Countries," Public Policy Centre, World Gold Council, London, June 1999 (<http://www.gold.org> accessed September 13, 2000).

³ World Gold Council (hereafter WGC), *Gold Demand Trends* no. 30 (February 2000): p. 1.

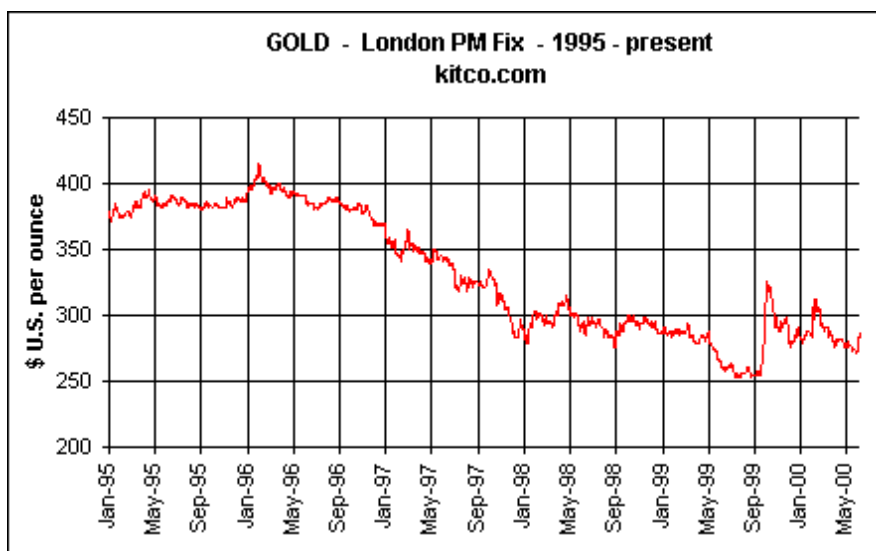
⁴ *Ibid.* pp. 2-12.

⁵ The Gold Institute, *World Gold Production 1840-1996* (<http://www.goldinstitute.org>), accessed September 15, 2000.

States, where production expanded almost fivefold to almost 11 million ounces through new ore washing technologies, making the U.S. the second largest producer after South Africa. Developing countries in Latin America and more recently in West Africa have also increased production. As a result, total world production rose from 44 million ounces in 1982 to 82 million ounces in 1998.⁶

Most recently, however, new exploration and increases in production have slowed due to depressed prices. Recent price instability emanates from movement in stocks (and projected movement in stocks) above ground, rather than new production. Spurred by a general trend on the part of a small number of central banks to sell gold reserve holdings in favor of higher yielding assets, the most recent slide in the price began in 1996 (Figure 1).

Figure 1: The Price of Gold 1995 to 2000



Source: Kitco, Inc.⁷

More recent price volatility stemming from uncertainties over the intentions of central banks provided the backdrop for a resurgence of concern in early 1999 when the IMF announced its intention to sell a significant portion of its gold holdings in order to finance its share of promised debt relief to poor countries. This was followed in May by the U.K.'s surprise announcement that it would reduce its gold holdings to 300 tons from 415 tons through a series of actions. Combined with short-selling by speculators trying to read the actions of the central banks, these announcements drove the price to its lowest level in 23 years. Under pressure from the United States, the IMF sales did not occur, and the price recovered in September 2000 after European countries signed an agreement with Washington, limiting gold sales to 2000 tons over the next

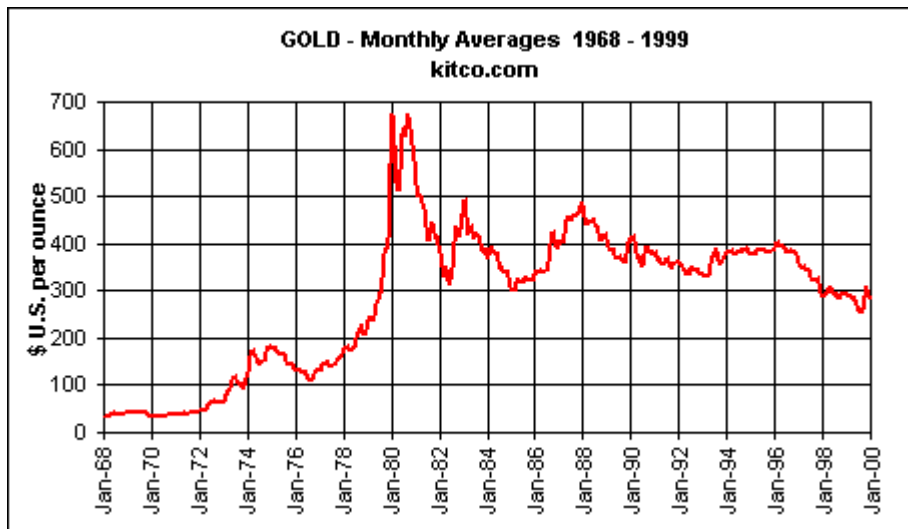
⁶ The Gold Institute, "World Gold Production to Remain Flat Through Next Four Years," *ibid.*

⁷ Kitco Inc., <http://www.kitco.com/charts/historicalgold.html> accessed September 2000.

five years.⁸ Figure 1 demonstrates a wide price range for the year, from a low of US\$252.80 per ounce in mid-July to a high of \$325.50 in early September.

Taking a longer term view, however, permits a broader analysis of the potential impact of price on low-income countries like Mali. From 1968 to early 1980, gold prices rose steadily (Figure 2). Since 1980, prices have leveled off, and the 1999 volatility seems less pronounced. A very long-term view (Figure 3) indicates that 1980 was the anomaly, not 1999. This view demonstrates that the period since 1971, the end of the gold standard, has proven to be a highly volatile one.

Figure 2: The Price of Gold, 1968-1999



Source: Kitco, Inc.

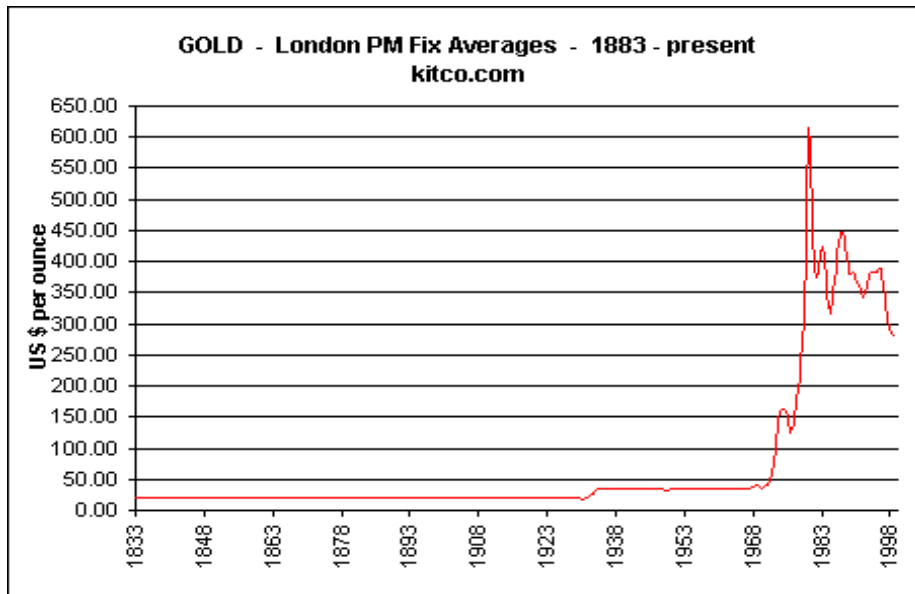
The effect of this price volatility on poor countries exporting gold can be great. The World Gold Council estimates that the \$100 fall in gold price in 1996-97 cost sub-Saharan African gold exporters (excluding South Africa) \$400 million in export earnings.⁹ For countries like Mali and Ghana, where gold ranks especially high among commodity exports, the IMF estimates that a \$20 fall in price would cost each country 3 percent of export earnings from gold.¹⁰

⁸ WGC, *World Gold Demand Trends*, p. 16.

⁹ Plowden and Wilde, p. 9. South Africa is estimated to have lost \$1.44 billion.

¹⁰ Correspondence from Stanley Fischer of the IMF to Haruko Fukuda, CEO, World Gold Council, 13 August 1999, (http://www.gold.org/Gra/Recent/IMF/IMF_1.htm) accessed September 13, 2000.

Figure 3: The Price of Gold, 1833-1999



Mali and the Gold Market

The zone (both land and people) of what is now the Republic of Mali has played a central role in the international gold market since gold became a globally traded commodity at the end of the first millennium. Traditional mining techniques continue among the *orpailleurs* of rural Mali, located in some 250 to 350 sites across the country.¹¹ It is only since 1970, however, that post-colonial legislation by the Republic of Mali actively encouraged modern mechanized exploration and production. Industrial gold production began in Mali in February 1990, when SOMISY extracted gold ore from the Syama mine southeast of Bamako. Production that first year totaled almost two tons, but grew to over four tons by 1996. Revised legislation in 1991 ushered in a new exploration phase on the southwestern edge of the country, in the vicinity of Kayes. Production began there in the Sadiola mine in 1997, under SEMOS, and with this rich new vein total Malian production grew rapidly.

In 1998, Mali ranked fourth in sub-Saharan gold production, after South Africa, Ghana, and Zimbabwe, and 16th in the world (Table 1).¹² While increased production of gold in Mali is good news for SEMOS and SOMISY, the question is how this increased production affects the quality of life and future prospects for Malians. With gold second only to cotton as a source of foreign exchange, Malian policy makers are rightly asking what the country is getting out of the production and sale of this non-renewable resource. How the gold sector affects national growth

¹¹ See below for a full description of the traditional, or “small-scale” sector in gold mining in Mali. For the purposes of this report, “large-scale” is used to denote what is referred to by policy makers as the “modern” or “mechanized” or “formal” sector; “small-scale” refers to the “traditional,” “artisanal,” “non-mechanized” or “informal” sector. The terminology is important since many of the small-scale activities are modern, mechanized or semi-mechanized, and highly formalized in terms of customary law, even if not always by the written law.

¹² The Gold Institute, “Production to remain flat...”, *op. cit.*

and development is not only a result of taxes and wages paid, but also a function of intersectoral integration. Integration between mining and other sectors depends on a number of first- and second-order effects other than taxes and wages. First-order effects result from linkages between the mining sector and other sectors and the improvements in infrastructure and human capital generated directly and indirectly by the industry. Backward linkages consist of the industry's demand for locally produced intermediate inputs and capital goods, as well as final demand for finished goods on the domestic market. Forward linkages consist of the raw gold made available for jewelry making in the local market. While some first-order effects, such as taxes, wages and linkage effects, are easily quantified (see below), calculating the development impact of improvements to infrastructure and, especially, human capital is far more difficult and complicated.

Table 1: World Gold Production, 1998

(thousands of ounces)

South Africa	14 982
United States	11 716
Australia	9 999
Canada	5 337
Indonesia	4 686
Russia	4 093
Peru	2 868
Uzbekistan	2 591
Ghana	2 357
Papua New Guinea	2 032
Brazil	1 781
Chile	1 446
Philippines	1 122
Zimbabwe	871
Mexico	839
Mali	707
Kyrgyz Republic	707
Bolivia	556

Source: The Gold Institute

Second-order effects include expenditure of factor incomes on nontradables, final demand for nontradable goods and services by industry suppliers, a portion of the taxes paid by those suppliers, and expenditure of tax revenues by the central government. Only the last of these variables is difficult to quantify since tax revenue is fungible and central governments – Mali's included – do not tend to trace particular revenue streams from source to final expenditure.

Each of these first- and second-order effects exists in both the large- and small-scale sectors. However, measuring them depends on available data and is therefore more easily replicable and

reliable in the case of large-scale mining. The total of these first- and second-order effects provides a reasonable static estimate of the economic impact of the sector.

Measuring the total economic impact of the sector allows policy makers to estimate the total value added of production of this particular resource. In the case of gold ore, as a fixed input to other industries (jewelry and bars), value added from its production approximates the quasi-rents available from permitting access to this resource.¹³ “Quasi-rents” exist when supply is fixed for certain inputs in the short run, and therefore changes in price do not affect the quantity of those inputs made available. “Quasi-rent” refers to the payment above what would otherwise be necessary to attract a given amount of that input, and becomes a function of demand. The greater is the demand for the input, the higher will be the price assigned to the fixed supply. In the short run, gold is in fixed supply, since significant investment in exploration is required to increase known reserves. While the international gold market is nearly perfectly competitive,¹⁴ nation-states like Mali have the discretionary power to award concessions to producers for the right to mine the gold ore and bring the gold to market. Whatever difference exists between the average variable cost of production and the world price of gold is quasi-rent, and depends on the nature and extent of known reserves (and thereby the marginal cost and benefit of exploration and extraction). Whether such rents flow to the firm and its shareholders or to the host country and its citizens is a key policy question. Usually these rents are apportioned between the producer firm and the host country in accord with agreements reached on taxes and profit repatriation. Ultimately, governments should seek to maximize the rents accruing to the host country subject to the constraint of providing profits to the firm sufficient to keep it operating within the country. The total economic impact of the sector is the closest and most complete approximation we can have of the rents retained by the host country. Comparing that figure to the export value of gold enables an estimate of the relative shares of the rents staying in versus leaving the country.

But there is a broader policy question. Should the gold be mined now in its entirety? Or is it in Mali’s best long-term interest to leave it in the ground and delay production pending an increase in the price of gold? Gold reserves *in situ*, known and unknown, represent one of the most important assets of the Republic of Mali. A static analysis of rent recovery for one particular period cannot account for the more dynamic variable of intergenerational equity: Malian policy makers must worry not only about the demands of the current generation for income and improved living standards but also the demands of future generations. What is the optimal rate of exploration? What is the optimal rate of extraction?¹⁵

¹³ See Thomas Mansfield, *Microeconomics, Theory and Application* (New York: Norton, 1982) or any microeconomics text for a fuller discussion of rents and quasi-rents.

¹⁴ The criteria necessary for perfect competition include a homogenous product, a large number of buyers and sellers, perfect information on prices and bids, and easy entry and exit of firms and customers in the long run. Only this last condition is questionable in the international gold market.

¹⁵ Answers to this question lie outside the purview of this report. However, AIRD developed a simple simulation model for DNGM that permits a thumbnail analysis of the present user value of gold reserves *in situ* – see below.

THE LARGE-SCALE SECTOR¹⁶

Description

Large-scale mining takes place in Mali today at three locations. SOMISY, the Société des Mines de Syama, began to produce gold in February 1990 at the Syama mine, located 300 km southeast of Bamako. An international consortium controls the company, consisting of Randgold (South Africa) 75%, Mali 20%, and the International Finance Company (IFC) 5%.¹⁷ The mine has not been as productive as had been hoped, and was able to increase production to 4.5 tons in 1998 after a major restructuring and investment program.¹⁸ Still, Randgold was not able to post profits until the year 2000 when the Morila mine deal was concluded. The latter is a joint venture among AngloGold (South Africa) and the government of Mali, under which production was expected to begin in October 2000. SEMOS (Société d'Exploitation des Mines d'Or de Sadiola) is also an international consortium which developed the Sadiola mine in the southwest near Kayes, beginning production in 1997. Sadiola – a high-grade open pit mine with known reserves exceeding 110 tons¹⁹ – is far more productive than Syama, producing 16.3 tons in 1998, compared to Syama's 4.7 tons.²⁰ An international consortium also controls SEMOS: Iamgold (Canada) 38%, AngloGold (South Africa, and the largest gold mining company in the world) 38%, the government of Mali 18%, and the IFC 6%.²¹ The average cost of production at Sadiola is \$102 to \$112/oz, and is expected to increase to \$148,²² whereas production at Syama has historically surpassed \$210/oz.²³ A new mine is just opening in Morila, where known reserves total 161 tons and resources are 169 tons.²⁴ An equal joint venture between Randgold and AngloGold was to begin production in the fall of 2000.

Interest is growing in Mali's future potential in gold production. While only six detailed geological maps have been created of a possible 133 spannings for the country, interest in exploration has been strong. Twenty-two businesses had received exploration concessions through 1998. The most promising potential reserves lie in Yatela (40 tons), Kodeiran (80),

¹⁶ Data for the analysis of first- and second-order effects within the large-scale subsector were updated with assistance from Mali's Direction Nationale de Géologie et des Mines (DNGM), and based on information gathered by BECIS, a Malian firm under subcontract to BUGECO, a Belgian firm. The original data were published in a report entitled "Evaluation de la contribution du secteur minier à l'économie du Mali" (Braine-l'Alleud, Belgium: Bureau of Geological Consultancy S.A. – BUGECO, December 1998).

¹⁷ Plowden and Wilde, p. 32.

¹⁸ Ibid.

¹⁹ Iamgold Corporation (Markham Ontario, Canada), <http://www.iamgold.com>, accessed September 22, 2000.

²⁰ DNGM.

²¹ Ibid.

²² Iamgold website, accessed September 18, 2000.

²³ Plowden and Wilde, p. 32.

²⁴ Randgold Resources Ltd., "Annual Reserve and Resource Declaration December 1999," <http://www.randgold.co.za>, accessed September 19, 2000.

Segala (40), Tabakoto (60), Loulo (64) and Kalana (40).²⁵ The DNGM forecasts that production may begin at Yatéla in 2001, at Kodiéran and Tabakoto in 2003, and at Loulo in 2004.²⁶ Annual production is expected to increase from an estimated 23.7 tons in 1999 to over 40 tons by 2004.²⁷ All together, including the reserves at Sadiola and Syama, known recoverable reserves in Mali are estimated at approximately 800 tons. Mali thus dwarfs its West African neighbors, which, with the exception of Ghana, harbor much smaller gold reserves (Burkina – 7 tons, Senegal – 6 tons, Guinea – 6 tons).²⁸

First-order effects

Gold has grown increasingly important to the economy of Mali in recent years, due to its role in generating foreign exchange. Tax revenue is also significant. The direct employment effects of the large-scale sector are limited, however. Backward linkages within the economy are robust, forward linkages (at least for the large-scale sector) non-existent, and improvements in infrastructure and human capital significant but limited to the populations and areas immediately surrounding the two mines in active production. In 1997, total production amounted to more than 16 tons (12.6 for SEMOS and 4.1 for SOMISY).²⁹ The contribution of the two mines to 1997 GDP is valued at CFAF 68.9 billion, equal to 5.3% of GDP.³⁰ The total value of gold exported that year was CFAF 110 billion, equal to 39% of export revenue, making gold the second most lucrative source of foreign exchange for the country, after cotton (the export value of which was CFAF 146 billion, 52% of Mali's total).³¹

Taxes

The large-scale mining sector benefits from significant tax incentives during the exploration phase. The Mining Code of 1970 (Convention BHP), under which SOMISY originally conducted its exploration, required companies in the research phase to invest a minimum of \$1.5 million during the first two years, including salaries and amortization. Companies were expected to pay certain licensing fees, a land tax, a business services tax (*Impôt sur les Affaires et Services*, IAS), and withholding taxes on salaries and wages (IGR, CFE, TFP and INPS on Malian personnel only).³² During the exploration or research phase and for the first three years of extraction, companies are exempt from all trade taxes (including customs rights, import duties, common levies on regional West African trade and service taxes). In addition, they may avoid for that period all profits taxes; corporate land tax; taxes on vehicles, patents, and value added; and all excise duties levied on certain products. Revisions to the mining code in 1991 (under

²⁵ PAMORI 2, and DNGM.

²⁶ Republic of Mali, Direction de la Géologie et des Mines (DNGM).

²⁷ Ibid.

²⁸ Ibid.

²⁹ BUGECO, p. 11.

³⁰ Ibid., p. 5.

³¹ Ibid., p. 9.

³² ABT, "Etude de la Fiscalité du Secteur Minier," PAMORI (Projet de Mobilisation des Ressources Intérieures – Bamako: ABT), Draft May 2000 (hereafter PAMORI), Table 1, p. 9.

which SEMOS conducted its exploration and early extraction -- Convention AGEM) doubled licensing fees, increased area taxes, and introduced a new withholding requirement for expatriate employees (IGR, CFE, TFP and INPS). The new code also eliminated the tax on business services (IAS), excluded vehicles not directly used on site from the vehicle tax exemption and removed the CPS (*Cotisations sur les prestations des services*) from the list of exemptions on imported goods. All other exemptions remained in place.

Table 2: Taxes paid by SEMOS and SOMISY, 1995-1999

(m CFAF)								
		1995	1996	1997	1998	1999	Total	
							5 years	
Taxes sur salaires (CFE)								
	SEMOS	85	201	363	421	492	1563	
	SOMISY	219	185	281	315	261	1260	
Cotisations sociales (INPS)								
	SEMOS	226	552	997	1355	1564	4693	
	SOMISY	532	455	698	779	772	3235	
CPS et taxe ad valorem								
	SEMOS	15	9	4814	5636	6142	16615	
	SOMISY	1395	1404	1499	1455	1780	7533	
Retenues IRF/Loyers								
	SEMOS	0	0	0	0	7	7	
	SOMISY	0	0	0	0	0	0	
Droits Enr. Timbre								
	SEMOS	24	0	0	0	0	24	
	SOMISY	0	0	0	0	5	5	
Droits de douane								
	SEMOS	3	377	127	137	107	751	
	SOMISY	1863	2337	5415	6679	4311	20605	
Total	SEMOS	352	1139	6301	7549	8312	23653	
	SOMISY	4009	4380	7894	9227	7128	32638	
TOTAL		4361	5519	14194	16776	15440	56291	
Source: PAMORI, pp. 16, 18 (Tables 2, 4)								
Données de 1997 (italique) sont utilisées dans la Table 5								

Total taxes paid by the industry from 1995 through 1999 amounted to CFAF 56.3 billion, or approximately \$94 million: CFAF 23.7 billion for SEMOS, and CFAF 32.6 billion for SOMISY (Table 2).³³ Another CFAF 1.2 billion came in from companies in exploration in those years, of which 106 million was collected in 1997 (Table 3). It is worth noting that SEMOS benefited from the full slate of exemptions during this period. SOMISY, in contrast, paid all regular taxes except the import duties due on petroleum products. By far the largest outlay for SEMOS in those years was the CPS and the *ad valorem* tax on production, amounting to more than 75% of all taxes paid in 1999. SOMISY, in contrast, paid up to 70% of its taxes in customs duties, due in part to the lower productivity of the mine and in part to the larger tax liability it faced across the board. SEMOS posted profits in the second year of extraction: CFAF 38.6 billion in 1998 and CFAF 40.5 billion in 1999 (equal to \$64.3 million and \$67.5 million, respectively).³⁴ The effective rate of taxation (TAV+ CPS as a share of profits) for SEMOS in 1998 and 1999 was 17.18% and 15.15%, respectively.³⁵ Taxes on wages, expressed as a share of profits, ranged from 4.6% in 1998 to 5.2% in 1999.³⁶

Table 3: Taxes paid by companies engaged in research, 1997

(m CFAF)	
IGR sur salaires	56,3
CF	13,0
CFE	31,1
Taxes douanières	2,1
Taxes de logement	3,6
TOTAL	106,1

Source: BECIS, p. 60 (Table 44).

Jobs and wages

Total employment in the large-scale mining sector (research and production) amounted to 1496 in 1997, the most recent year for which data is available.³⁷ Of this, 1349 were Malian citizens and 147 were expatriates.³⁸ In that year, mining companies paid a total CFAF 3.1 billion to

³³ PAMORI, Table 2 for SEMOS data (p. 16); Table 4 for SOMISY (p. 18). US\$ equivalents calculated here and elsewhere in the report at CFA600/US\$.

³⁴ PAMORI, Table 3 (p. 17) and Table 5 (p. 18).

³⁵ Ibid., p. 17. A similar calculation is not possible for SOMISY as it did not post profits in those years.

³⁶ Ibid.

³⁷ Bureau d'Etudes, de Conseils et d'Interventions au Sahel (BECIS), "La Contribution du Secteur Minier à l'Economie Nationale," (Bamako: BECIS, December 1998). Prepared for and annexed to Bureau of Geological Consultancy SA (BUGECO), *Evaluation de la contribution du secteur minier à l'économie du Mali* (Brain-l'Alleud, Belgium: BUGECO, December 1998), *Projet d'Assistance Technique au Secteur Minier*, Ministère des Mines et de l'Energie, République du Mali, p. 36 (hereafter BECIS).

³⁸ Ibid.

Maliens in the form of wages and salaries, and a little over CFAF 3 billion to expatriates.³⁹ The average wage for Malians paid by the companies ranged from CFAF 1.2 million per month for companies engaged in exploration to CFAF 2.3 million for companies in production (companies in exploration require less skilled labor).⁴⁰ The average monthly wage of CFAF 1.2 million is equal to more than 50 times the minimum wage (CFAF 20,965 per month) and 15 times the average wage in the modern sector of the economy (CFAF 79,417).⁴¹ When domestic subcontractors are included, who pay less than SEMOS or SOMISY and presumably employ a larger proportion of semi- and unskilled workers in their total labor pool, the average sector wage declines but still remains far above the average in the modern sector. The monthly salary across the large-scale gold mining sector is 195,432 CFAF, 9 times the minimum salary and 2.46 times the average in the modern sector of the economy. By comparison, 30% of cotton growers earn at least 2 million CFAF per year (166,666 per month). Average monthly salaries in fishing and livestock are CFAF 31,595 and 35,093, respectively.⁴²

Backward linkages

Backward linkages for the industry include demand for locally produced intermediate inputs and capital goods and final demand for finished goods and services on the domestic market. Backward linkages are considerable, although they have been overestimated by previous analyses.⁴³ In Mali, gold mining companies in production rely on local markets for approximately 44% of inputs, not including energy (Table 4). Capital equipment and petroleum products are most important. However, even intermediate inputs that are purchased locally have imported content. For example, previous analyses have valued petroleum products as a 100% local purchase. However, earlier studies show that only 54% of the value of these products can be considered as nontradable or local content. This portion comes from a combination of taxes and value added in the form of salaries to Malian workers, interest, and profits. The CIF (cost, insurance, and freight) value of petroleum imports accounts for the other 46%.

³⁹ Ibid., p. 40 (Table 23).

⁴⁰ Bureau of Geological Consultancy SA (BUGECO), *Evaluation de la contribution du secteur minier à l'économie du Mali* (Brain-l'Alleud, Belgium: BUGECO, December 1998), *Projet d'Assistance Technique au Secteur Minier*, Ministère des Mines et de l'Énergie, République du Mali, p. 15 (hereafter BUGECO).

⁴¹ BECIS, p. 8.

⁴² Ibid.

⁴³ The BUGECO report overestimated the domestic proportion of purchases by the mining industry by calculating purchases of petroleum products as 100% domestic. In contrast, our analysis employs coefficients of tradable/nontradable components specific to the Malian economy to calculate the share of imported and domestic content in each of the industry's inputs. For example, petroleum products in the first order analysis are treated as 46% imported, since the historical cif value of petroleum products has accounted for 46% of the retail price. The remainder – in this case 54% -- reflects local taxes, transport, wages and profits to the Malian importer.

Table 4: Backward Linkages for Mining Companies in Production, 1997

	(A)	(B)	(C)	(E=B+C)	(F)	(G)	(H = I+J+K)	(I)	(J)	(K)	(L=E*(G+H))
	Imports (m CFAF)	National (m CFAF)	Local (m CFAF)	Non - échangeable (m CFAF)	Valeur CAF (part)	Taxes (part)	Valeur ajoutée (part)	Salaire	Intérêt	Profit	Impact Total au Mali (m CFAF)
Produits de traitement	2700	2148	100	2248	0,42	0,28	0,30	0,22	0,01	0,07	1304
Carburant/lubrifiant		12545		12545	0,46	0,36	0,18				6774
Equipement /pièces de rechange	12500	6583		6583	0,42	0,28	0,30	0,22	0,01	0,07	3818
Fourniture/bureaux	50	152		152	0,51	0,36	0,13	0,03	0,01	0,09	74
Autres achats		2198	966	3164	0,51	0,36	0,13	0,03	0,01	0,09	1550
Total											13521

Sources: BECIS report, page 23, Tableau no. 10 (colonnes A-E); Stryker et Shepard (colonnes F-K); Données pour la SEMOS et la SOMISY

Table 5: Upstream Effects of Mining Companies during Research Phase, 1997

(Millions CFAF)	(A)	(B)	(C)	(D =A*C)	(E=B*C)	(F)	(G)	(H = I+J+K)	(I)	(J)	(K)	(L=E*(G+H))
	Import part	Local part	Total	ECH	Non-ECH	Val Caf	Taxes part	V A part	Sal	Intérêt	Profit	Impact
Carburant/lubrifiant	0	1	372	0	371,684	0,46	0,36	0,18				200,70936
Matériel/équipement	0,66	0,34	813	536,5404	276,3996	0,42	0,28	0,30	0,22	0,01	0,07	160,311768
Fourniture/bureaux	0,25	0,75	34	8,48925	25,46775	0,51	0,36	0,13	0,03	0,01	0,09	12,4791975
Electricité	0,45	0,55	209	94,1427	115,0633	0,45	0,19	0,36	0,22	0,04	0,1	63,284815
Autres	0,51	0,49	6,8	3,468	3,332	0,51	0,36	0,13	0,03	0,01	0,09	1,63268
Total												438,4178205

Source : BECIS p16 table 4 (Achats bruts 1997) ; STRYKER et SHEPARD (coefficients Echangeables – Non Echangeables pour le Mali, colonnes F – K)

Note : le ratio achat étranger/local des compagnies en recherche a été extrapolé à partir de celui des entreprises en production (colonnes A et B)

Table 4 indicates that the nontradable portion of purchases of intermediate inputs and capital goods by companies actively extracting gold in 1997 totaled CFAF 13.5 billion, or about \$22.5 million.⁴⁴ Companies in the research phase in 1997 spent a total of CFAF 438 million on local intermediate inputs and capital goods, another \$731,000 (Table 5).

Final demand for finished goods and services (Table 6) by the two companies extracting gold in Mali in 1997 ranged from foods to motor vehicle maintenance to pharmaceuticals. The data collected by BECIS are very complete and indicate that purchases of these goods and services by

⁴⁴ Estimates are based on BECIS data.

the two companies amounted to CFAF 245 million, or over \$400,000.⁴⁵ Total backward linkages in 1997, therefore, amount to approximately CFAF 13.96 billion.

Forward linkages

Forward linkages would exist in the form of output -- raw gold – being made available to the Malian market for processing and jewelry. No large-scale finishing industry exists outside of the initial processing conducted by mining companies. Primary smelting of the ore into ingots that are 96% pure takes place under the direction of SOMISY and SEMOS, which then move the product to export to Europe for final processing into raw gold at a cost of \$4-7 per ounce.⁴⁶ Functionally all of production is sold as exports for refining (96%).⁴⁷ There is no evidence that the large-scale sector releases any of the residual production onto domestic markets for jewelry-making. All of the gold that remains in Mali for this purpose apparently comes from the small-scale sector (see section on Informal Sector).

Improvements in infrastructure and human capital

The large-scale gold mining sector has contributed much to communities surrounding the mines. According to the BUGECO study, together SEMOS and SOMISY have expended CFAF 4.5 billion on local infrastructure. By far the greatest portion of this – CFAF 2.4 billion – was earmarked for new housing sites for communities displaced by the mines. Another billion was slated for construction of the Kayes-Sadiola road. The rest, more than one billion francs (or about \$2 million), went to provide water supply, health clinics, schools, food and programs in support of particular populations (CFAF 4 million, about \$7000, for example, went to training and credit programs for women).⁴⁸

In addition, training programs for mining personnel also contribute to the overall productivity of the Malian workforce (to the extent that skills development is transferable). In 1997, SOMISY financed training for 84 workers, lasting from a few days to several weeks, at a total cost to the company of approximately CFAF 53 million (about \$88,000).⁴⁹ SEMOS also ran training programs for almost 200 employees in 1998, and has earmarked a multiyear budget of CFAF 3 billion (about \$5 million) for training.⁵⁰

⁴⁵ BECIS, p. 26. Estimates of final demand for finished goods and services by companies engaged in research is not available for 1997, but arguably would represent a small percentage of final demand by companies in active production.

⁴⁶ DNGM, BUGECO p. 11.

⁴⁷ BECIS, p. 28.

⁴⁸ BUGECO, p. 19.

⁴⁹ BECIS, p. 41.

⁵⁰ Estimates of these expenditures for 1997 in the calculation of the total economic impact of the large-scale mining industry are based on a prorated portion of the total budget. Total profits in 1998 and 1999 for SEMOS amounted to approximately CFA 80 billion, or \$133 million.

Second-order effects

Second-order effects of the large-scale mining sector include expenditure of factor incomes on nontradables, demand for nontradable goods and services and intermediate inputs for industry suppliers and subcontractors, a portion of the taxes paid by those suppliers, and expenditure of tax revenue by central government. All but the last of these effects have been estimated by existing studies and are summarized below.

Expenditure of factor incomes

Factor incomes in the case of large-scale mining in Mali consist of the wages and salaries paid to Malian workers. The expenditure of that income on local goods and services constitutes an important second-order effect of the industry on the economy. Income to capital is assumed to flow outside Malian borders, given that the capital investment in the large-scale sector comes from foreign direct investment (except for the share of sector investment financed by the government of Mali).

The BECIS study conducted in 1998 estimated annual expenditures by formal sector mining employees at an average of CFAF 1.1 million, leaving about CFAF 1 million as potential savings for the average worker.⁵¹ The companies cover most housing and transport costs directly. Purchases related to health and education account for approximately 1% of income each, confirming that here, too, the companies subsidize social costs of living for their employees. Virtually 100% of employees' expenditures can therefore be considered nontradable. The items that account for the largest expenditures by employees include, in descending order of importance, cereals (14% of income), condiments (9%), clothing and personal products (5% each), social events and meats (4% each).

Final demand by industry suppliers and sub-processors

Industry suppliers and subcontractors are defined as those companies that provide goods and services to the mining industry under contract. A total of nine contractors and 14 suppliers of the Sadiola and Syama mines were surveyed for the 1998 study. Total purchases for these companies – both finished goods and intermediate inputs – amounted in 1997 to CFAF 245 million (about \$408,000).⁵² Goods and services ranged from commercial purchases to auto repairs.

Taxes paid by industry suppliers and sub-processors

Both foreign and domestic contractors are subject to taxation under Malian law. It is important to note that the share of these revenues that can be attributed to mining activity is determined by the share of total business activity devoted to work for mining companies. These are estimated at 40% for larger contractors and 80% for small local suppliers⁵³ (for the purposes of this analysis

⁵¹ Data for this paragraph is taken from BECIS, p. 58. Data are calculated for a sample of workers at SOMISY and SEMOS and do not reflect the expenditures of workers at companies engaged in research.

⁵² BECIS p. 26.

⁵³ BUGECON pp. 11 and 3 respectively.

the analogous figure for the foreign-owned companies working locally for mining concerns is assumed to be 100%).

Total levies and taxes paid by foreign-owned contractors (including the commercial and industrial profits taxes, customs taxes, and domestic taxes such as VAT, tax on services, CF and others) amounted to CFAF 2.315 billion (about \$3.9 million) for the period from 1994 through 1997.⁵⁴ The majority of that revenue accrued in 1997, with more than CFAF 742 million (more than \$1.2 million) paid in taxes in 1997 alone.

Major domestic contractors paid a total of CFAF 31.4 million (\$52,000) in taxes for the four-year period, and CFAF 7.8 million (\$13,000) in 1997,⁵⁵ of which about 40%, or CFAF 12.6 million (\$21,000) is traceable to mining activity for the period and CFAF 3.1 million (\$5200) for 1997. Local suppliers paid average annual taxes of under CFAF 16,000 (business, licenses, development taxes, IGR, VAT and taxes on wood purchases).⁵⁶ The total second-order effect of mining in the form of tax contributions therefore is approximately CFAF 2.33 billion for 1994-1997 and CFAF 750 million for 1997 (a little more than \$1.25 million).

Analysis of the Large-Scale Gold Mining Sector's Contribution to the Malian Economy

Table 6 summarizes the impact of the large-scale mining sector on the Malian economy. The total impact is significant for 1997, CFAF 35.5 billion, and given higher production levels in 1999 and 2000 it is likely to have increased since then. It is not as large as other estimates have suggested, however.⁵⁷ Those analyses did not take into account the tradable (imported) portion of intermediate inputs and other goods and services purchased by mining companies and their suppliers and sub-processors. Calculated as a portion of the value of total gold exports in 1997 – CFAF 110 billion – the total quasi-rents retained in the economy amounted to 32% of the value of the resource produced that year. While it could be argued that this rate is not typical due to SEMOS' exemptions, it is also true that DNGM expects five new consortia to begin production within the next four years; exemptions for some companies will continue for the foreseeable future. Additionally, in 1997, direct taxes from all large-scale companies represent only 40% of the total impact; the rest is primarily backward linkage effects, with some marginal impact from wages and second-order effects.

⁵⁴ BECIS, p. 61.

⁵⁵ Ibid. p. 62.

⁵⁶ Ibid.

⁵⁷ The total value added of the large-scale mining sector on the Malian economy was estimated by BUGECO on the basis of BECIS data at CFA 68.9 billion, equal to 5% of Malian GDP (BUGECO, p. 3).

Table 6: Impact of Large-Scale Gold Production on the Malian Economy, 1997

First-Order Effects	(m CFAF)				
	Taxes				14300
	Employment, Wages	(1)			3142
	Backward Effects				13960
	Forward Effects				0
	Infrastructure and Human Capital Development (2)				1518
Second-Order Effects					
	Factor expenditures				
		Expenditures per worker (m CFAF/an): 1.1			
		Malian and Foreign Workers (3): 1496			
		Total Expenses for the year			1646
	Final demand of suppliers and subcontractors				245
	Taxes paid by suppliers and subcontractors				
		Foreign suppliers: 742			
		Domestic suppliers: 3			
		Total for year			745
Total Economic Impact of Large-Scale Gold Sector in 1997					35555
Export Value of Gold from Mali, 1997 (m CFAF)					110000
Percentage of value of resource retained in the country (rent):					32,32%
Sources: See text.					
(1) Only expenses by Malians are taken into consideration; expatriate salaries are assumed to be repatriated 100%					
(2) The total budget for infrastructure, CFAF 4.5 billion, is not actualized; 1/3 of the total represents expenditures for 1997 only (simplification)					
(3) Average expenses of 147 expatriates have been included (see note1)					

THE INFORMAL SMALL-SCALE PRODUCTION SECTOR

The phrase "small-scale production" applies to two very distinct kinds of activity, e.g. small size gold mines, and traditional gold-mining artisanal activities, known in French as "*orpaillage*".

Small mine operations are not very different from formal mining companies in the way they are run and regulated, though their production remains at a lower level because of limited means. This limitation does not mean that those mines are run as informal businesses. Far from being artisanal operations, they rather stand at an intermediate level between large mining companies and artisanal enterprises. The latter does belong to the informal sector and is the subject of the following sections.

Description

The following sections describe both the actors involved in the sector, and the methodology that was used for our study.

Various Actors Involved in the Sector

Artisanal or traditional gold mining has been practiced in Mali for a very long time. These small-scale operations use rudimentary techniques to process precious substances like gold and diamonds, obtained from gold fields or primary deposits located near or above the earth's surface. Operations are typically organized by village communities. The management structure runs in a traditional and simple way the successive phases of the operation, from the village where a gold field is located to the various actors along the production chain.

➤ The Village Management Structure: Land Ownership

Management consists of an association of landowners headed by the *Damantigui*, i.e. the chief of the village where a gold field exists. This landowner is assisted by a council of *Tonboloma* (landowners' representatives), who are ubiquitous on the site and are charged with policing it. Council members are assigned to the various gold-related activities that take place in the field. They collect, on behalf of the village, the fees that some actors are required to pay (non-government taxation). One such fee is collected from traditional gold mining operators and from owners of generators and motor pumps. It includes a fixed component and another component that is directly proportional to daily output. Specifically, the fee amounts to CFAF 5,000 for the fixed component, and 1% of daily output for the variable component. In some cases, an operator who wishes to purchase a plot may be required to use the "services" of a village native.

➤ Traditional Gold Mining Operators

The traditional operators described here are owners of plots assigned by the village management structure, who pay the corresponding fee (CFAF 5,000 and 1% of their output). Legally, they are supposed to hold a gold mining operator card that gives access to the field for one year and costs CFAF 500, but they may not have the card, since the bureaucracy is very inefficient. This category thus excludes people who run abandoned pits, mining workers, and other actors. This

category of the *tonden*, as traditional gold mining operators are called locally, is one of the components of the management structure, on which our analysis will focus. *Tonden* may be persons or legal entities, and their activity may be individual or cooperative. Nor is the *tonden* required to give prior evidence that he holds a deposit, which for instance is the case for small mines. Artisanal gold extraction ranks very high in the informal sector, and is subject to an annual taxation of CFAF 10,585.

➤ Owners of Generators and Motor Pumps

Theoretically, generators, motor pumps, and other means of production are part of the traditional gold-mining operator's equipment. In practice, however, because of financial capacity problems and for deep-seated sociological reasons, traditional gold-mining operators do not own this equipment.

Owners make this equipment available to traditional gold-mining operators in exchange for one-third of their daily output for the time required to pump water out of the shaft and tunnel. This sharing system does not always apply, and generators and pumps are usually reallocated whenever no one owns all of the necessary equipment. The role of the "motor-pump operator" introduces important new management elements:

- Reliance on water pumping services alters the deep-seated traditional character of cooperative or collaborative relations in the gold extraction process. With generators and motor pumps in the system, gold producers are placed under a constraint of "no zero output", which does not alter relations among gold-mining operators, but cannot be faced very long by an associate who already faces profitability constraints because of his fixed and variable costs.
- Pumping services intervene only at specific stages along the production process: services cannot be called for until the "*naira*" is reached, and are only used if progress is blocked by water pressure.
- This situation provides a basis for estimating daily output under constraint, through an assessment of the portion (one-third) of that output that goes to the gold-mining operator's associate. Short of continuously following the operator's activities, and in the absence of any production or sales recording, the best method, which we have adopted, is to keep track of that associate's operations (see Annex 3).

Operating costs (salaries, maintenance, repairs, fuel and lubricant, amortization etc.) are borne by owners or their representatives. They can expect to receive a contribution to their expenditures of approximately CFAF 2,000 (depending on the case) every two weeks from each plot owner.

They are subject to the property fee and state taxes - the professional tax ranges between CFAF 25,000 and 50,000 per year, and the access card, which is valid for the same duration as the gold-mining operator card, costs twice as much (CFAF 1,000 instead of 500). This taxation is considered here to be their total tax liability, since no itemization is provided for artisanal mining taxation, contrary to what is done for other informal sector activities. This applies as well to mining operators, mining workers and other agents.

➤ Miners

These are all individuals who participate directly in gold extraction at any stage, who are not owners of pits or motor pumps, and who are not salaried employees in the previous category. Theoretically, they should hold an access card that costs CFAF 500. Such workers are entitled to receive, depending on their position along the production process, a certain part of the gold produced or some unsifted soil that they will process on their own as do the operators of old abandoned pits.

➤ Weigh Station Operators

They are a key link in the chain of artisanal production. They enable other actors to quantify their daily output, so as to distribute it as needed. The weighing service they offer is free. They are the money holders, and thus the spot buyers of the output. They purchase on their own account and/or on someone else's account, but always in their own name, and they are paid a commission by the persons they represent. Very often they advance money to pit owners and mining workers. The instruments used are quite simple, e.g. scales and a magnet to remove impurities. They are subject to taxation, and must hold an access card. Although they are categorized as "Other", their role is quite significant.

➤ Blacksmiths and Food-stall Operators

They have to pay for the access card (CFAF 1,000) and are subject to taxation. Blacksmiths pay CFAF 5,200 to 9,000, depending on the case, and food-stall operators are supposed to pay CFAF 14,700 in taxes. They purchase in the village or elsewhere the goods necessary to their trade, depending on the case. Through the goods and services they sell, they participate in providing maintenance and replacement of manual tools and food for the gold producers.

➤ Jewelers

Jewelers are included here, since they work downstream of gold extraction, and thus are the logical consumers of the product. A survey was conducted among jewelers in order to confirm or refute information obtained from gold-mining operators about the geographical distribution of their gold sales.

Survey Methodology

The survey was conducted with the various actors mentioned above, at Traorela, a gold field located in the 3rd administrative region, and at Kokoyo, located in the 2nd region. Previously, a survey had been conducted in the Bamako district with local jewelers, in order to identify forward links of artisanal gold production. To make this discussion easier to follow, however, we will first deal with equipment and work organization on the mining sites.

a) Equipment and Work Organization

- Instruments of the Trade: Manual Tools

Instruments of the trade are primarily rudimentary manual tools. Examination of those instruments provides two kinds of important information. On the one hand, the type of tools used helps situate the user along the production chain as either a surface worker or a pit worker. The battery flashlight is used only by workers in the tunnel, whereas a container of some kind, tied to a rope, is the typical instrument for lifting unsifted soil from the tunnel, and the calabash is used in the washing process. The other reason for highlighting these tools is to suggest how antiquated such instruments are. Indeed, using a calabash to wash and filter gold does nothing to minimize losses; penetrating the crust with a pick is not easy, nor is it feasible as a time-saving technique except in areas where nature is particularly helpful.

- Work Organization and Positions Along the Production Chain

As one can imagine, work in the gold field is relatively well organized. From the opening strike to abandonment of the tunnel, all work is done by teamwork and proceeds in an orderly fashion.

1. Penetration of the Crust (Code 301)

This is the first step in the gold extraction process. Except for miracles, this step produces no output until the "*naïra*" is reached. In average, two four-person shifts work eight hours each until they reach the vein; work is then taken over by pitworkers-miners-washers. This phase lasts an average of five days.

2. Penetration, Extraction and Deep Washing: Work in the Tunnel (Code 202)

Depending on the gold content of the underground, the average number of daily shifts in the tunnel varies, and also the number of washing days for the surface team. The richer the vein, the more reluctant pitworkers-miners-washers are about forming a second shift for tunnel work. The single shift works an average of eight hours per day, instead of four hours if two three-worker shifts were to take turns. This second stage is the most delicate in the gold extraction process, since there is a significant risk of collapse of the tunnel.

3. Lifting and Processing of the Ore: the Surface Team (Codes 301 and 302)

Lifting is done manually, as of course with all other tasks. Lifting, which is the initial phase of processing, is performed by permanent members of the surface team and by independent miners who will be compensated with ore allowances, in quantities that vary according to the number of liftings they have performed. Processing of the ore consists in washing - except when gold is present in hard matter, which calls for pounding. It is performed by two teams of men and women who work in average seven hours a day for six days. Permanent members of those teams are entitled to their quota of the production.

b) The Sample

The survey comprised 149 individuals, including:

- 103 gold-mining operators;
- 5 blacksmiths;
- 8 weigh station operators;
- 6 representatives of motor-pump owners;
- 1 female food-stall operator, and finally
- 26 jewelers from the Bamako district.

What follows is a detailed description of the role of traditional mining operators, pit owners and mining workers in the gold production process, and of the allocation and geographical distribution of the product. Since work on the pit is based on a moral contract, all actors feel that to some extent the pit belongs to them. However reality is simpler, and allows to distinguish owners from workers. The issue is clarified by responses to several questions: use of family vs. non-family labor, mode of remuneration, and payment of the land ownership fee.

Given the abundance and broad dispersion of information, streamlining was required in order to reduce the dispersion and get more reliable data, leading to tabulation of the distribution or breakdown of artisanal gold product. Under that approach, the variable that was retained, after calculations of average, standard deviation and coefficient of variation, is the number of months a person has attended a work site (*tpsite*); its critical value was determined to be 48 months. For calculation and tabulation purposes, we have retained only the individuals in the survey who had reached the critical value (*tpsite* \geq 48). That threshold led us to break down the concerned population into two main groups:

- the target group (*tpsite* \geq 48), which we examine in depth so as to record the effects of artisanal gold production;
- the other group, i.e. those whom we exclude.

In this descriptive section, however, we take into account all of the 103 gold-mining operators in the survey, with a secondary distinction in the "excluded" group, i.e. the place of birth, which leads to splitting the group into "locals", born in various regions of the country, and "foreigners" who reported a foreign birthplace. We can thus use three major categories for a more detailed description of those actors. The 103 persons in the survey have been broken down, leaving aside the degree of reliability of other responses, into 57 plot owners and 46 miners or mine workers.

➤ Miners

The 46 individuals in the survey are first classified according to their job position along the gold extraction process, and then broken down into our major categories. The result is shown in Table 7, Table 8, and Table 9.

Table 7: Distribution of Miners Sample

	Number	%
<i>Tpsite</i> >=48 months	10	22
<i>Tpsite</i> <48 months		
"locals"	11	24
"foreigners"	25	54
TOTAL	46	100

On the basis of Table 7, which shows a first distribution of the sample of workers according to the critical value and the birth place, one can first see that the target group is relatively small as compared with the other group ("locals" and "foreigners"), and that the latter are in greater number. This may initially be explained by the seasonal nature of gold work for many of the actors, since production is difficult during the rainy season, considering also that a greater number of workers are from villages across the border. If we go to Table 8 for further breakdown of the three categories into job positions (202 to 302), we find that women are relatively dominant among washers (Code 302) and that surface workers (Codes 302 + 301) are relatively dominant over below-ground workers (202); overall, however, artisanal gold extraction remains dominated by men.

Another finding is the relative domination of the underground team over the surface team. This is an abnormal situation, which has to do with the availability of workers for interviews outside work hours. Table 9 combines the two preceding tables, with lines corresponding to a group and columns corresponding to job codes, and confirms previous findings.

Table 8: Distribution of the Sample by Groups and by Job Codes

Jobs	<i>tpsite</i> >= 48 months	Locals	Foreigners	Total
202 (below ground)	6	4	7	17
301 (surface)	1	3	6	10
302 (washing)	3	4	12	19
Total	10	11	25	46

Table 9: Distribution of the Sample, in Percentage

	202	301	302	total
<i>Tpsite</i> >= 48 mois	13	2.2	6.5	22
Locals	8.7	6.5	8.7	24
Foreigners	15.2	13	26.1	54
Total	37	22	41	100

➤ Landowners

There are 57 landowners, 18 of whom are foreigners and 4 females (one is a foreigner); each owns one or more pits, on which groups of men and women gather and pool their energies to produce gold. It is therefore useful to describe this category and understand the motivations, difficulties and constraints that are specific to it.

Of the 39 Malians, 15 have been present on the site for 48 months or longer. No woman is in that situation. As was the case for workers, we can classify landowners into three categories: "target group", "locals", and "foreigners".

First-order Effects

In order to measure the impact of artisanal gold production on other economic activities, it is necessary to be able to trace the product distribution. This requires making a count first of pit, generator and motor-pump owners, and miners, and then of all other activities gravitating around artisanal production .

A matrix based on accounts of operating results will lead to a table showing the distribution of the product of artisanal extraction. Starting from the basic table, we will – to the extent that reliable data is available for the various categories of actors – disaggregate the account of operating results in order to achieve a more detailed breakdown. The basic assumption for the trade matrix is that no reciprocal services are exchanged between the mining operator, the miners and the motor-pump owner; this corresponds to the current practice in artisanal production.

On the basis of data collected on work hours, working conditions and sharing modes, it would be possible to determine (although we did not do it) reliable average criteria relating to hourly rates, working hours of miners and machines; that would lead to a table showing cross-linkages between those different actors.

Whether the work day is "constrained" or not, and even when there is no recourse to water pumping service, it is clear that the mining operator and the miners consume goods and services from all other activities gravitating around gold production; in return, however, no category except "Other" is a direct consumer of the product of the artisanal activity. This absence of a return effect is not a discovery, since it was a known factor. Demand is the true engine of production; only a growing and sustained demand for gold will lead to an increase in revenues from artisanal production.

Resources (value added) procured by traditional gold mining are distributed between the village (fees), the state (taxes and duties), salaried employees, miners and various owners (Table 10).

Table 10: Distribution of Traditional Gold Mining Product

	Operator	Pit	Surface	Pump	Blacksm.	Other	Food
Operator						4264	
Pitworker						6069	
Surface						11313	
Motor pump						8988	
Blacksmith	366	150	450			247	
Other	2770	4443	4725	8988	496		27875
Food stall	1128	1476	6138		717	18416	
Total	4264	6069	11313	8988	1213	49297	27875
Value added	36744	16485	7141	32020	4700	18020	12640
Total resources	41008	22554	18454	41008	5913	67317	40515

	Total	State	Village	Salar.	Gross	Op.Result
Operator	4264	30	8215		28499	41008
Pitworker	6069	4			16481	22554
Surface	11313	12			7129	18454
Motor pump	8988	8801	4115	9429	9675	41008
Blacksmith	1213	23			4677	5913
Other	49297	169	14		17837	67317
Food stall	27875	43		467	12130	40515
Total	109019	9082	12344	9896	96428	236769
Value added	127750					
Total resources	236769					

Table 11: Structure of Production and Value Added

(%)	Total Production	Total Value Added	Ratio Value added/Production
Pit owner	17.3%	28.8%	89.6%
Pmfl	9.5%	12.9%	73.1%
Rls	7.8%	5.6%	38.7%
Motor-pump owner	17.3%	25.1%	78.1%
Maintenance industry	2.5%	3.7%	79.5%
Other	28.4%	14.1%	26.8%
Food Stall	17.1%	9.9%	31.2%
Total	100.0%	100.0%	54.0%

Whatever denominator is adopted, either production or total resource, total value added or production and value added branch by branch, the same trends remain in the distribution of the product of traditional gold mining.

Tax Revenues and Ownership Fees

Traditional gold extraction does not actually produce as much as one might imagine, in terms of village and state revenues, even though the village seems to get a better deal than the state:

- The ownership fee, as estimated in the study, is effectively collected by the village structure that manages the real estate. Its amount, determined on the basis of the constrained work day, corresponds to 9.7% of the value added calculated on the same basis.
- Tax revenues as estimated, 7.10% of the value added, are lower than revenues effectively collected.⁵⁸ This situation reflects the central government's reluctance at tracing activities that cost more than they earn. Substituting regional subdivisions and local communities to the central government is the best way to recover tax revenues from the traditional sector, and thus bolster treasuries: with local authorities close to them, miners cannot indefinitely escape, and returns to those local authorities should exceed their management costs.

Employment, Wages and Salaries: Intersectoral Effects

In spite of the low level of employment, the share of salary incomes is slightly higher than the share of estimated state revenues; the percentage stands at 7.74% of the value added. It is important to go beyond this simple number.

No wages would be paid directly in the traditional gold sector if there were no recourse to motor pumps. Thus those informal activities cannot, by themselves, help solve the employment problem, and a profound change will be needed in order to get to a wider distribution of salary incomes. Such a change would require that traditional gold producers have some kind of ownership (in economic terms) of modern equipment, with all kinds of related management problems to be solved.

Do traditional mining practices hamper agriculture or slow down its development? Do they subtract more from the agricultural sector than they contribute to it? In this study, we focus on a limited number of simple aspects of the question:

- Human resources that are removed from agriculture more or less permanently, as persons working in both sectors may choose to abandon agriculture and practice mining activities exclusively.
- Harmful effects of traditional gold extraction on the environment.

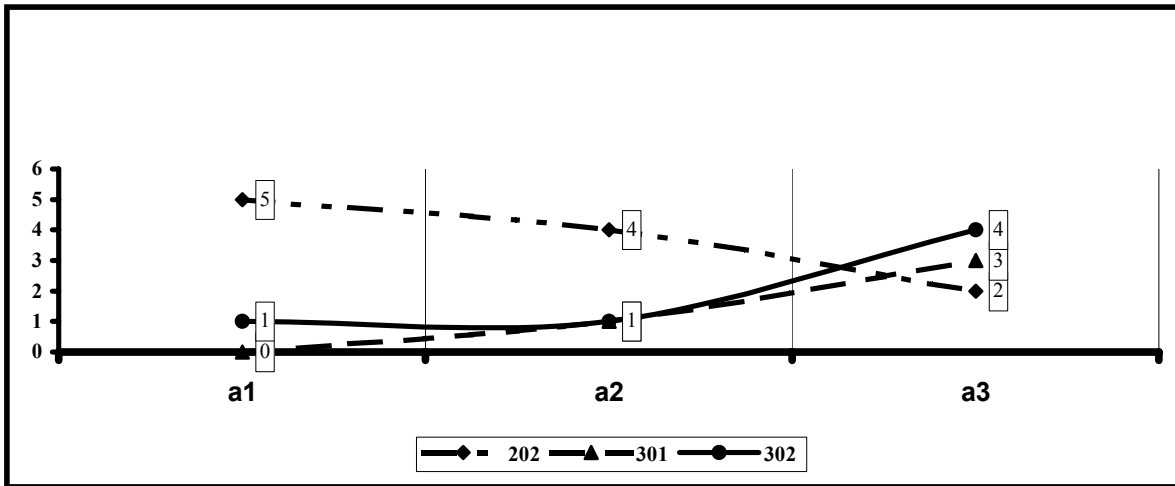
Reallocations of labor or other factors of production from one sector to another are simply the desire to maximize returns to those factors. Such reallocations are classic economic behaviors.

⁵⁸ If we take only the case of the 103 individuals to illustrate the situation, we see that only one had paid the gold-mining operator card fee. Tax avoidance is a nearly universal practice.

➤ **Mining Workers**

The price factor should thus be taken into account when examining the issue of reallocation; another factor is the percentage of mining workers who spend some of their time in agriculture; this percentage is 45.7% of workers. Across the three categories of workers, it appears that the leading group in terms of time availability for agriculture is the pitworkers-miners-washers group (Code 202), followed by Codes 302 and then 301.

Figure 4: Time for agriculture, by type of job and by category of population



This is easy to explain, since work conditions are very difficult during the rainy season. For 202 workers, not only is there a higher risk of accidents, but, most of all, earnings prospects are weakened by natural difficulties and inadequacy or lack of availability of the means of production. For groups 302 and 301, work difficulties are less of a problem than the low level of earnings. For locals residing in the immediate and nearby areas, gold mining work is generally seen as a secondary source of income.

Table 12: The Agriculture Question - Mining Workers

	0 time	1 time	2 dry s.	3 rainy s.	1 time indifferen t	22 stays	price
Target group	1	5	1	1	3	3	2
Locals		4	3		1	3	1
Foreigners	5	2	2			2	
202	6	11	6	1	4	8	3
Target group	1						
Locals	2	1			1	1	
Foreigners	3	3	3			2	1
301	6	4	3	0	1	3	1
Target group	2	1	1				1
Locals	3	1	1			1	
Foreigners	8	4	3	1		3	1
302	13	6	5	1		4	2

Further breakdown of time availability indicates that, while "target group" and "locals" lead in the 202 group, "foreigners" lead the other groups (Table 12). The graph is easy to read: the target group is shown between the y-axis and the first vertical line; "locals" (a2) are shown between first and second vertical lines, and "foreigners" (a3) between second and third vertical lines.

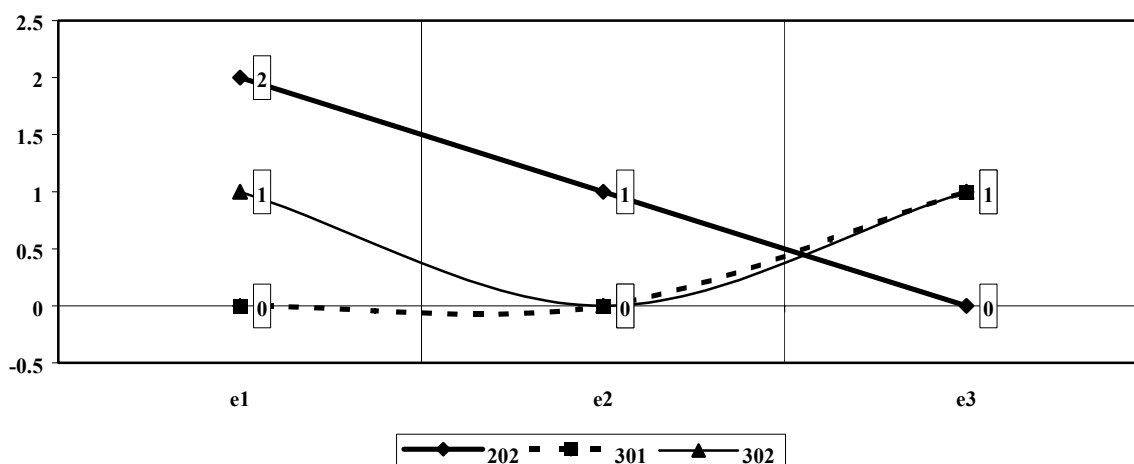
Workers' sensitivity to the price of one gram of gold is analyzed with eloquent results, quite irregularly distributed over the periods examined. For a price of CFAF 7,000 per gram, workers make an extra effort (hours, days per week, months), i.e. 66.6% of Code 1 (type of response to the agriculture question). Numbers of workers reacting may be classified as follows, in decreasing order: 6 for Code 202, 5 for Code 302, and 3 for Code 301. In the cases of 302 and 301, the situation is explained by the dominating presence of "foreigners", since native residents show a lower sensitivity.

Summing up, findings are as follows:

- 38.10% of 202 workers prefer combining both activities
- 14.3% of both 301 and 302 workers prefer combining both activities
- When we examine the numbers of those who claim to wish to stay and practice both activities and compare them with the numbers of those who have time available, we find the ratio to be very high: 60% for 202 "target group" workers, 75% for 202 "locals", 100% for 202 "foreigners"; in Code 301, 100% for "locals", 66.6% for "foreigners"; in Code 302, 75% for "locals", 75% for "foreigners".

On the basis of such findings, it would be hard to assert that workers, in spite of their price-sensitivity, are rushing to abandon agriculture - an activity that is even less risky than mining. The mine is for many a source of secondary income.

Figure 5: Those Wishing to Abandon Agriculture



Six of the workers (28.6% of the population examined) said they wished to dedicate themselves solely to gold mining work. Needless to say, they represent the counterbalance to those workers wishing to stay (cf. graph above). Those persons who wish to abandon agriculture are the ones who are sensitive to a price level of CFAF 7,000.

However, it is worth examining the price levels cited by those workers. They range from CFAF 7,000 to 25,000 (10,000 in average), while at the time of the survey prices varied between CFAF 4,500 and 5,000. If one considers that the local price of gold is dependent on the world price and the United States dollar, and if one takes into account what is reported by workers about the relative stability of prices, as well as prices offered by jewelers for processed gold, it would be highly unlikely that local prices could double. Therefore decisions to abandon agriculture in the immediate future seem unlikely.

Mine workers are sensitive to the price of gold, and admit that if gold prices rise, they are willing to work especially hard at mining, mainly during the period between the harvest and the beginning of the next planting season. However, they are not ready to quit agriculture in favor of gold production work. Several factors explain such behavior, and support the notion that traditional gold production plays a secondary role as a source of additional income for farmers.

➤ Traditional Gold Mining Operators

We still retain the three categories examined previously, going even further in the analysis. We start with two main headings:

- no time for agriculture or any other activity besides gold mining. Under this heading, we have 4 lines: "foreigners", "locals", "target group", and total for the column;
- time available: under this heading are sub-headings for the 3 main categories, and each category has 4 lines: (1) persons who are sensitive to the price level indicated, and willing to make an effort during the dry (and cold) season; (2) persons willing to make an effort during

the rainy season; (3) persons unwilling or unable to make any extra effort in any kind of weather; (4) total for the column. Categories are listed in the same order as under the first heading.

Among landowners, 31.6% (18 persons) have no time for agriculture while 68.4% (39 persons) have time available. One of the 18 persons, or 1.8%, is in the target group. These percentages, by comparison with those found for workers, indicate landowners' attachment to agriculture. When comparing the landowners who have time to the total population, one notes a similarity between landowners and Code 202 workers: in both cases the groups having time available are headed by "locals" and "target group" (28.1% and 24.5% respectively), with "foreigners" coming last (15.8%).

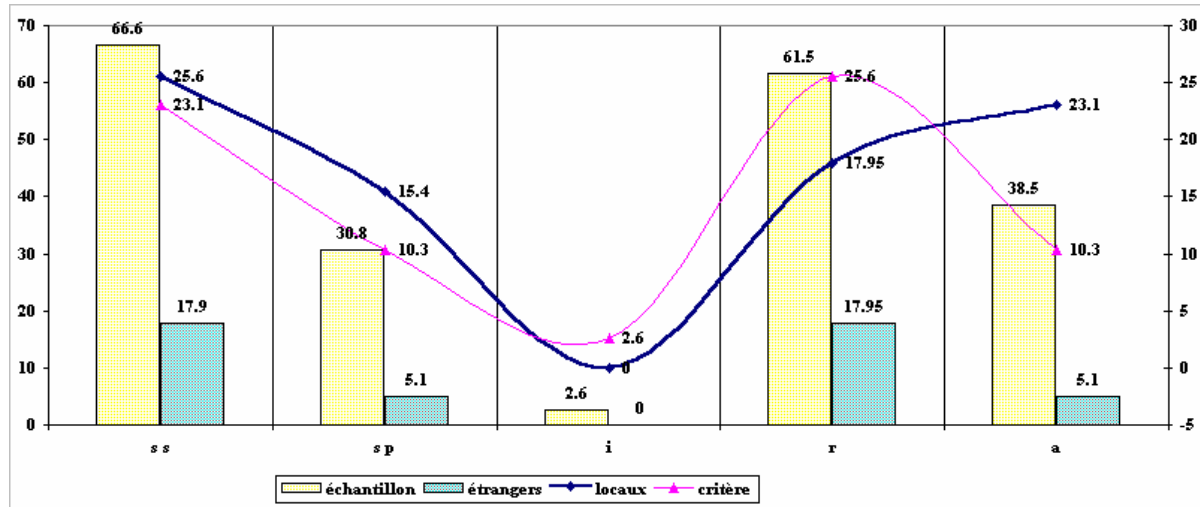
Table 13: The Agriculture Question - Gold Mine Operator's Time Availability

	Agricult. question/Time					Price level	Pit ownership					
	Effort dry season	Effort rainy season	No effort	Stays	Quits		1	2	3	4	5	
Foreigners 9				9			8		1			
Locals 8				8			6		2			
Target group 1				1			1					
18				18			15	0	3	0	0	0
Foreigners 7	7			6	1	8000	6		1			
Locals 10	10			6	4	7500-10000	7	3				
Target group 9	9			7	2	10000 - 15000	7		2			
26	26			19	7	[7500 - 15000]	20	3	3	0	0	0
Foreigners 2		2		1	1	7000		2				
Locals 6		6		1	5	7000 - 10000	6					
Target group 4		4		2	2	7000 - 7500	2	1				1
12		12		4	8	[7000 - 10000]	8	3	0	0	0	1
Foreigners												
Locals												
Target group 1			1	1								1
1			1	1	0		0	0	0	0	1	0
39	26	12	1	24	15	[7500 - 15000]	28	6	3	1	1	1
57	26	12	1	42	15	[7500 - 15000]	43	6	6	1	1	1

In terms of price-sensitivity, we reach the same result: owners are willing to make extra efforts in any season. However, this finding is stronger here than elsewhere when it comes to the rainy season, and also in terms of indifference to favorable price changes. As to intentions to practice both agriculture and gold production work, or to abandon the former in favor of the latter, the trends are unchanged: natives ("locals" 23.1%, "target group" 10.3%) are the most willing to

dedicate themselves solely to traditional gold mining if prices are in the 7,000-15,000 range; "foreigners" follow with only 5.1%.

Figure 6



Responses to the agriculture question seem to be somewhat homogeneous on the mine operators' side. Differences are due to the actors' diversified capabilities, more than to any other factor. Differences between the gold mining operator and the mining worker are tied to ownership of a pit and contract obligations that it entails.

Backward Linkages

Since linkages exist between the various activities of artisanal production, backward effects will occur. Contrary to what happens in a true industrial system, only spare parts and petroleum products used by generators and pumps are imported, while all other inputs and consumption goods and services are domestic products.

Table 14: Technical Coefficients

	Mine operator	Pit	Surface	Pump	Industry	Other	Food stall
Mine operator	0.000	0.000	0.000	0.000	0.000	6.334	0.000
Pitworker	0.000	0.000	0.000	0.000	0.000	9.016	0.000
Surface	0.000	0.000	0.000	0.000	0.000	16.806	0.000
Pump	0.000	0.000	0.000	0.000	0.000	13.352	0.000
Industry	0.893	0.665	2.438	0.000	0.000	0.367	0.000
Other	6.755	19.699	25.604	21.918	8.388	0.000	68.802
Food stall	2.751	6.544	33.261	0.000	12.126	27.357	0.000

Distribution of the artisanal product, over the area under consideration, is more or less intensive depending on who is the agent and what are his relations with that area.

In Table 14, industry suppliers are shown on the "Other" line. It is actually this category, along with weighers and other small businesses, who benefit directly from traditional gold mining activities. They are followed by the women who run the food stalls, who sell to nearly every category. Looking at the distribution table for the traditionally mined product, one realizes that backward effects cannot extend much further than the area surrounding the site.

Forward Effects

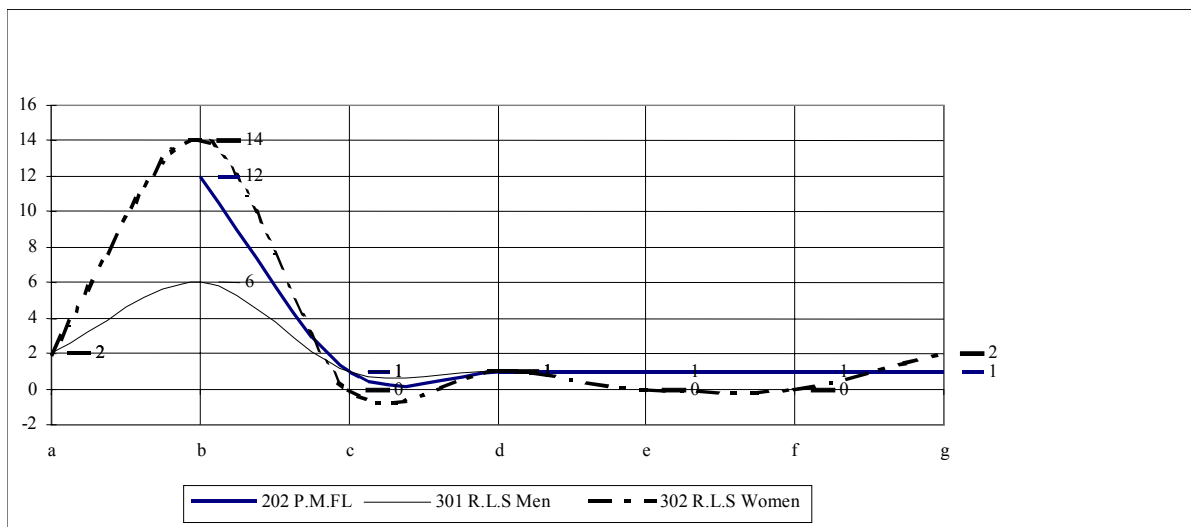
At the end of production and initial distribution, agents who hold gold may either sell it right away, or keep it to sell it later, or sell part of it while keeping a fraction of it according to their needs. Sales operations of that kind occur practically every day. While it is difficult to know exact quantities exchanged and their value, it is still possible to gather information from agents (miners, weighers and jewelers) so as to trace the primary geographical distribution of sales and understand what happens on the traditional channel of gold marketing.

➤ Mining Workers

Whatever group we consider, the dominant code is 10(b), i.e. sale of the output on site. This is easy to understand, since first priority expenditures occur on the work site, and must be financed by agents out of their own resources, or through borrowing from weighers or food-stall operators.

Sales on site are strongly prevailing among women (Code 302) and the pitwork team (202), and most particularly "foreigners".

Figure 7: Distribution of the three categories, by job position and by zone



This does not exclude the following:

- the existence of sales made outside the country (Code 12(c)) by "foreigners";
- sales made in the country's large cities (Code 11) by "locals", but the proportion is quite low, as confirmed by the survey among jewelers in the district, who also appear to play a very limited role in the distribution of traditionally produced gold;
- lack of sales (Code 0) is not necessarily the result of a willful determination not to sell; it may result from failure to procure gold.

Table 15: Sales Code: Geographical Distribution of Sales

	a	b	c	d	e	f	g
	0	10	11	12	101	102	104
Target group		5			1		
Locals		2	1				1
Foreigners		5		1		1	
202	0	12	1	1	1	1	1
Target group		1					
Locals		2	1				
Foreigners	2	3		1			
301	2	6	1	1	0	0	0
Target group		3					
Locals	1	3					
Foreigners	1	8		1			2
302	2	14	0	1	0	0	2

➤ Motor-Pump Owners

Owners of generators and motor pumps only sell on site the gold that they need to sell in order to be able to operate their machines on a regular basis, i.e. about 4 grams. The rest of their gold is sold in the city.

➤ Weighers

Weighers are major buyers, either on their own account or on commission or both; they also procure gold in repayment of money advances and loans; they then sell mostly in large urban centers and abroad, for example in the Republic of Guinea; since there are no sales registers or loan documents, it is difficult to quantify relations between weighers and traditional gold mining operators.

➤ Traditional Gold Mining Operators

Those who have time to dedicate to another activity besides traditional gold production represent 56.14% ("target group" 24.56%, "locals" 19.3%, and "foreigners" 12.28%) against 26.32% for

those who have no time available. The latter are responsible for exports, made by the "foreigners" group. Sales in large cities (8.77%) offer more substantial margins than sales on site; nearly 80% of city sellers are those who have time available ("locals" 59.98%, and "foreigners" 19.95%). The target group sells only on site.

Figure 8

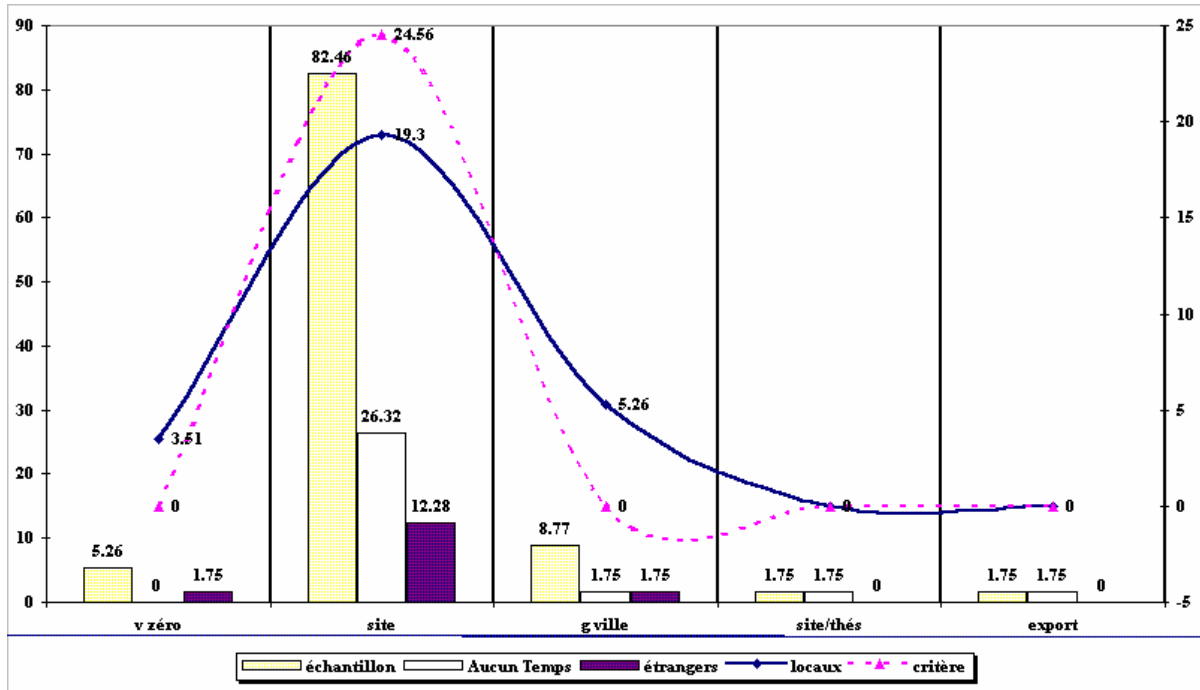


Table 16: Distribution of Sales

	no sales	site	city	abroad	site/hoarding
foreigners 9		8		1	
locals 8		6	1		1
target group 1		1			
18	0	15	1	1	1
foreigners 7	1	6			
locals 10	1	7	2		
target group 9		9			
26	2	22	2	0	0
foreigners 2		1	1		
locals 6	1	4	1		
target group 4		4			
12	1	9	2	0	0
foreigners					
locals					
target group 1		1			
1	0	1	0	0	0
39	3	32	4	0	0
57	3	47	5	1	1

Similarly to the sample of mine workers, where disguised exports were observed, landowners sampled appear to be selling on site, in the larger cities of the country and abroad, and they also partly abstain from immediate sales. Sales on site dominate according to all statements, in all groups and categories.

➤ Jewelers

All 26 jewelers interviewed stated that they were aware of the traditional gold mining sector, and had in the distant past purchased important quantities of gold directly from mining operators.

Only one jeweler said that on rare occasions he sends one of his relatives to buy gold. All declare that they do not use middlemen (weighers) to get their supplies of raw material. They buy old jewels from colleagues and from jewel owners who are in difficult situations. Their role in the distribution of artisanal gold production is marginal and decreasing.

Although no reliable data is available, it is clear that the domestic jewelry sector is no longer supplied directly by artisanal mining production as it used to be.

Second-order effects

Expenditure of Factor Incomes

Answers to the question about use of income by traditional gold producers emphasized two lines of expenditures:

- Food expenditures represent more than one-third of incomes, except for the target group. This simply reflects how hard life is for people employed in traditional mining. It is, however, worth noting that those in "target group" categories have a relatively more comfortable position than their peers in other categories.
- The "Other" line of expenditures is a mixture of everyday expenditures and savings.

Table 17: Expenditure of Incomes

(%)	food	clothing	housing	travel	housekeep.	leisure	other
Target group landowners	20.4	12.6	9.1	1.3	1.8	2.1	52.7
Local landowners	46.5	8.3	0.5	2.1	2.8	1.9	37.8
Foreign landowners	53.2	10.6	0.4	2.3	-	-	33.5
Miners							
Target group miners	33.5	14.5	10.3	0.9	7.5	1.3	31.0
Local miners	51.2	21.8	5.9	0.9	1.8	-	18.4
Foreign miners	50.9	11.0685	1.0	3.8	3.55	1.125	28.5565

Those income expenditures impact both the village and other locations.

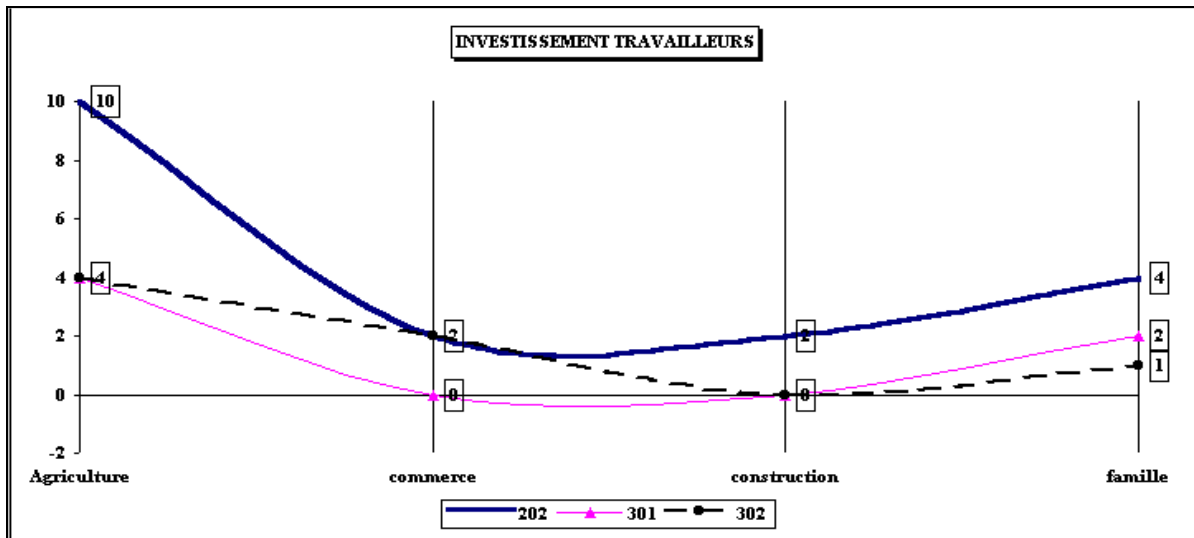
Savings and Investment

It is not easy to identify what is actually invested in agriculture, home construction, or family remittances. Logically, family remittances correspond to sums of money that serve everyday family needs rather than investments. However, a great number of the persons surveyed indicated that remittance money went into purchases of agricultural inputs (insecticides, pesticides), plows, carts, plow animals, donkeys, as well as payment of school fees for the children. Agricultural inputs cannot be treated as investments, even if they are so considered by farmers.

➤ Mining Workers

With the above observations in mind, it can be said that mining workers "invest" in agriculture, trade and "other investments" in the family and the building of sheet metal houses.

Figure 9: Workers' Investments



As shown on the above graph, miners' investments are concentrated in agriculture, for all job positions and categories, although categories are not specified on the graph. Those investments correspond (see observations mentioned above) to purchases of cultivators, plows, and animal traction carts (semi-mechanized and animal traction cultivation). Agricultural investments are practiced by all categories and all job positions. A look at the breakdown of investment by category and job position gives the following findings:

- Investing in agriculture may contribute to increases in productivity, yields and output, but it is doubtful that it will improve the quality of agricultural land and make farming activities more sustainable.
- What is most surprising is that absolutely no investment is made in the mines. This might help understand why antiquated tools are used.

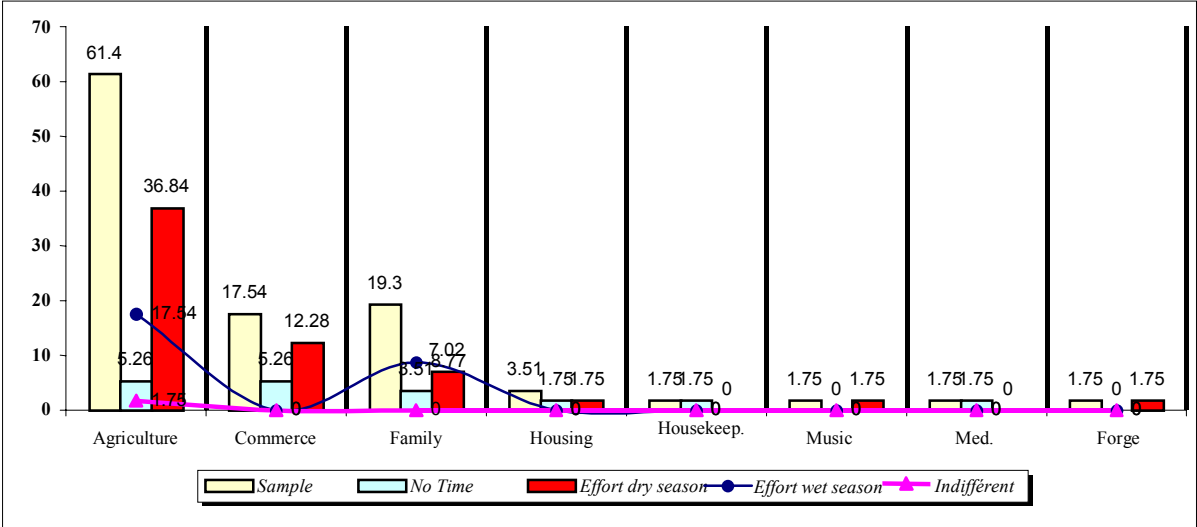
➤ Traditional Gold Mining Operators

First of all, we find a broader range of investment, even though the extent of the range and the intensity of activities are not very substantial when compared with sectors already represented in miners' investments, for example carpentry and forges.

It is no surprise that major investments are in agriculture. But all of that does not help improve soil quality or restore damaged land, or at least open prospects for improving agricultural productivity and output through such progressive changes as investment would bring.

Another significant finding is that no investment is made by landowners in modern equipment for their artisanal production. If such investment took place, inevitably a complete overhaul of the subsector would take place, leading to formal recognition of a trade.

Figure 10



Analysis

We are trying to determine the size of the artisanal production subsector (Table 18). This is made easier by disaggregating the gross operating results into final consumption, stock variation and gross fixed capital formation. The last two elements constitute investment, and the way investment is distributed between various sectors of the economy is a significant factor in the assessment of the size of an activity.

As stated above, we are only disaggregating the gross result, in order to determine incomes and their allocation. In the absence of data for the "Other" category and for the food-stall category, we have assumed, for those categories, that the gross operating result is the operators' income, and have allocated all of it to final consumption. For motor-pump operators, we have identified their annual amortization with their gross fixed capital formation. As to industry, equipment, or forges, operating results indicate only stock variation.

As far as mine operators, landowners and mining workers are concerned, capital formation is present in spite of confusions regarding what investment is. Examination of their gains and expenditures confirms the analysis of investment, both for "target group" landowners and for "target group" categories 202, 301 and 302. We had to take their investment into account, even though we already knew toward which sectors the bulk of such investment was directed, and we knew as well that such investment could not make artisanal production a nation-wide activity, but only a limited-scale, strictly local activity.

Table 18: Disaggregation of Gross Operating Results

	Total	State	Village	Salaries	Investment	C Finale	Total
Gold mine operator	4 264	30	8 215		11 866	16 633	41 008
Pitworker	6 069	4			10 383	6 098	22 554
Washing	11 313	12				7 129	18 454
Motor pump	8 988	8 801	4 115	9 429	2 404	7 271	41 008
Equipment	1 213	23			3 487	1 190	5 913
Other	49 297	169	14			17 837	67 317
Food stall	27 875	43		467		12 130	40 515
Total	109 019	9 082	12 344	9 896	28 140	68 288	236 769

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